SCIENTIFIC AMERICAN

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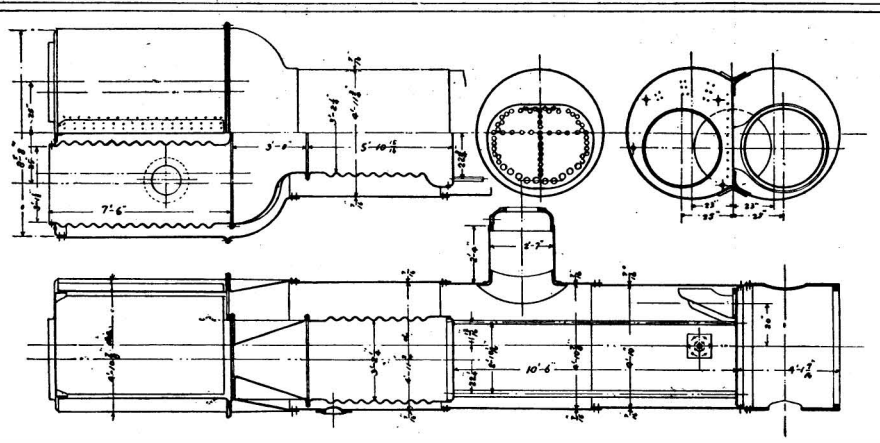
THE STRONG LOCOMOTIVE.

The locomotive of the present day is but little different from the machine of thirty years ago. The old fashioned slide valve of the D type has been retained, the boiler has for many years been of the tubular character, of so definite construction that the term locomotive boiler represents a well recognized structure. For a long time locomotive boilers were noted for carrying high pressures, but now they are distanced in the race, even the large marine boilers on steamships equaling or exceeding them in this respect.

The Strong engine indicates a departure in the construction of locomotives that is quite radical. The boiler and valve gear are of original design, and the results already achieved appear to be well in advance of the usual practice. The engine we illustrate can maintain a speed, it is claimed, of 60 miles an hour, and is credited with a mile in 47 seconds. These results were obtained while it was new, and not fairly limbered up.



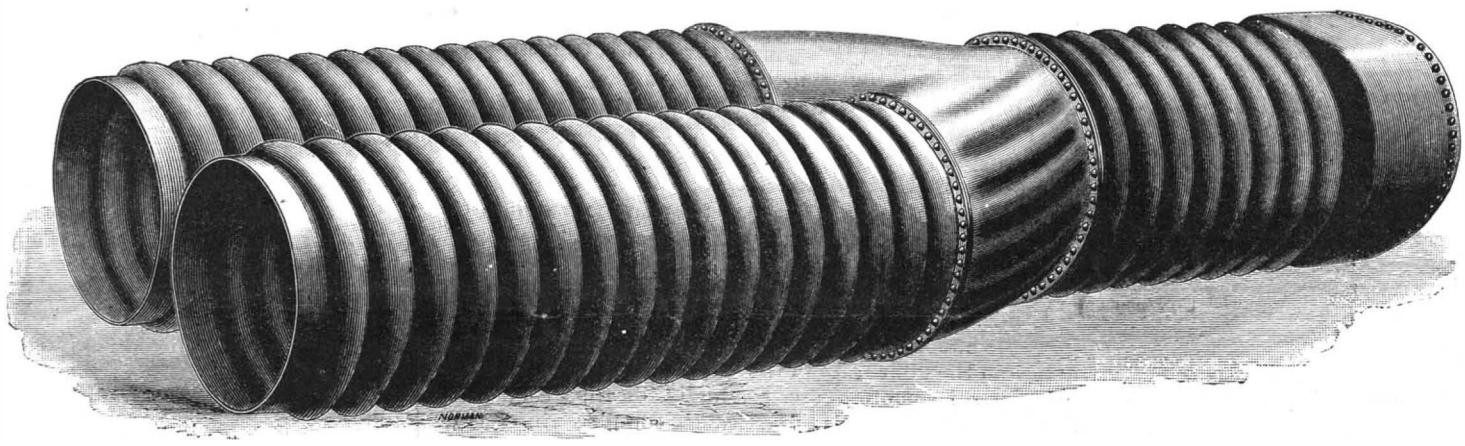
FIRE BOXES AND COMBUSTION CHAMBERS.

The boiler is bifurcated at the fire box end, forming two fire chambers, and contains two grates. The fire boxes are joined to a single combustion chamber which forms the next division of the boiler. These parts are made of corrugated steel plates with welded longitudinal seams. The combustion chamber abuts against the tube sheet. Forward of this comes the main body of the boiler, traversed by the tubes, 235 in number. The boiler shell incloses the two fire boxes and the combustion chamber, being itself bifurcated. As far as possible, all the elements of the shell are cylindrical. The connecting portions between the barrel and the bifurcated portion are of generally spherical outline, so that the ends are the only flat portions. A flexible shell exposed to internal pressure would naturally take the cylindrical and spherical contour. Thus the steam pressure does not tend to change the shape of the shell, but all the strains resolve themselves into tension, except of course for the flat heads. These are strengthened by gusset plates, but the tubes supply the principal element of bracing, otherwise the boiler is unstayed. A man can have access to every portion of the interior around the fire boxes. By using flanged seams, hand riveting can be dispensed with. Much of the shell can be shaped by hydraulic pressure.

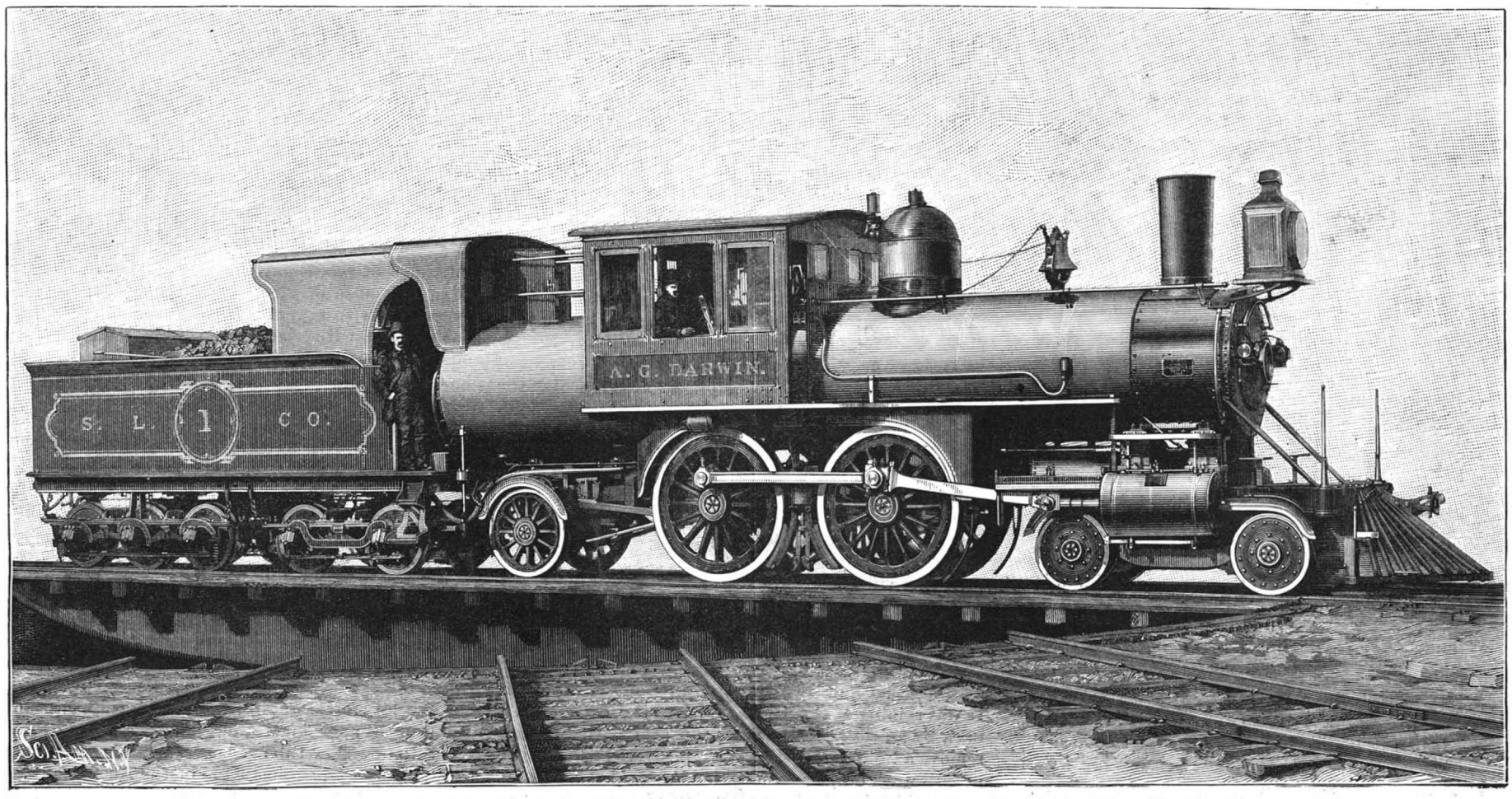
The two fires co-operate in burning the fuel. On one grate a very hot thin fire is kept, while a new fire is burning on the other. The latter gives off imperfectly oxidized gases which enter the combustion chamber. There they meet the hot oxidizing flame from the other fire, and are completely consumed. The fires are made to alternate in these roles. Thus almost any kind of fuel can be burned by one engine. The absence of stays and crown bars gives the boiler a character of unity that adapts it to withstand the strains and jarring inevitably attendant upon its work. Where a boiler is to be subjected to torsional and transverse strains, as in locomotive practice, every stay is an element of weakness, only admissible to enable the flat surfaces to stand the internal steam pressure.

The corrugated furnace chambers have, as our readers know, been extensively introduced in marine boilers. They have effected important economy in this

(*Continued on page* 18.)



CORRUGATED BOILER.



LOCOMOTIVE WITH DOUBLE CAB MANUFACTURED BY STRONG LOCOMOTIVE COMPANY.

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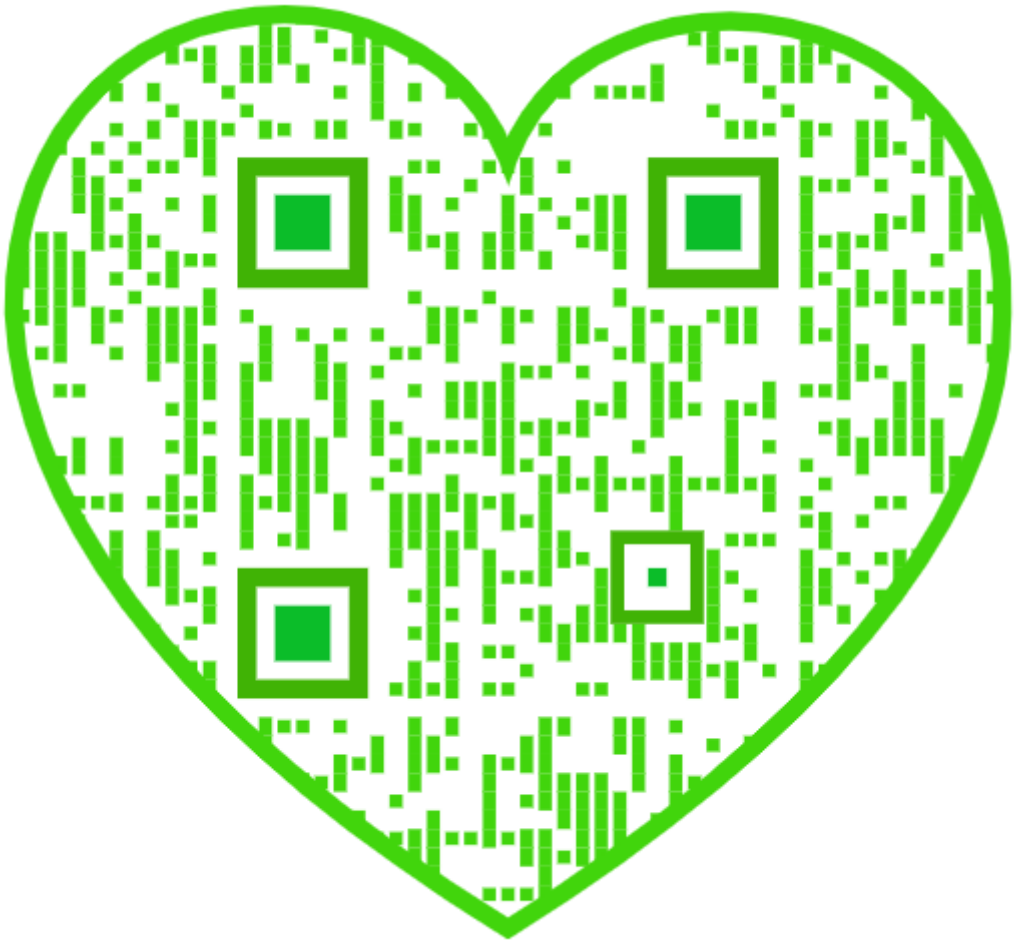

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NEW YORK, SATURDAY, JANUARY 12, 1889.

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THE DANGER OF ELECTRIC DISTRIBUTION.

Notwithstanding the susceptibility of the public mind to suggestions of alarm, it is doubtful if a full realization of the risk to which the members of the community are exposed from electric wires has been generally attained. If the recent law providing for death by electricity as the punishment of murderers never goes into effect, it will doubtless do its meed of good. It will cause a more thorough discussion of the subject in technical circles, and the idea and true conception of the danger will be disseminated among all.

Electric companies, whether supplying current for lamps or motors, have every inducement to increase the danger inevitably attendant upon their installations. The cheapest wire is the uncoated one. A wire however poorly insulated costs more; a properly insulated one is still more expensive. The quality of the insulation at the start is only one element—its duration when exposed to the weather is another. Insuring the latter gives a further increase in cost. As the network of wires grows thicker, and as the lines cross each other more often, an additional cause of deterioration appears. The contact of swinging wires with one another tends to rub off the insulation and expose the metal. The lines which have done the damage then serve as conductors to carry off the current, possibly to a telephone box or other place where it may do much harm.

Recent experiments in death by electricity which have been made upon animals illustrate the fatal nature of the dynamic shock. In the early days of the science, the static discharge of immense potential and very small quantity was considered the most fatal. It corresponded to the lightning stroke, both in its electrical characteristics and effects. Following the developments of the last decade, dynamic currents of very high intensity are everywhere in use, and these have been found to be deadly, though of comparatively low potential. It is such currents as these that imperfectly protected wires are carrying above the streets. When the dynamos are running, contact with wires conveying such currents is liable to be fatal. A broken wire that has fallen so as to reach from the top of a pole to the street has now come to be regarded as dangerous by the populace. The dread is only too just. Repeated deaths have proved it so.

It is futile to attempt to restrain the march of progress. No advance in practical science is more remarkable than the development of electricity. Goethe's prediction, true for so many years, is now being falsified. He said that electricity would only be applied to the minor uses of life. Now engines are driven by it, and the difficulties in the way of its application to outdoor locomotors are gradually disappearing. The electric light is practically complete in its development. But while no effort should be made to restrict the uses of the current, the fact that it is dangerous should not be overlooked. The rival exploiters of different systems claim each a higher degree of safety, or more properly a less degree of danger, for his own installation. The direct and alternating current advocates are engaged in active attack upon each other on the basis of the relative harmfulness of the two systems. One engineer has suggested a species of electric duel to settle the matter. He proposes that he shall receive the direct current, while his opponent shall receive the alternating current. Both are to receive it at the same voltage, and it is to be gradually increased until one succumbs, and voluntarily relinquishes the contest. The absurdity of the suggestion, which is made in apparent earnestness, shows how decided the war has become. Back of it all the fact remains that the working current of the day, direct or alternating, is dangerous. One solution seems adapted to protect the public. It is to properly dispose of the wires underground.

In examining the effects of the dynamic current upon the systems of animals, several points of interest have been developed. One such point is the small amperage required for a fatal result. Thus, with a current of 536 volts electromotive force a dog with a resistance of 11,000 ohms was killed. This reduces to a current of less than 0·05 ampere, leaving out of consideration the resistance of the dynamo. A horse weighing 1,230 lb. was killed by a current of about 0·06 ampere. In the case of the alternating current, the question of time seems to enter. A current requires a certain period to destroy life, which period varies with the current intensity. These data go to prove how slight a contact with the wires may be fatal. Sooner or later the plan of a modern city will have to provide some effective system of subways. The overhead wires will be a perpetual menace, will be the cause of death and injury.

But a few days have elapsed since a forcible illustration of these dangers occurred. A storekeeper in Meriden, Conn., started to take in some articles of clothing that had been hung up in front of his store. It was raining at the time. He was thrown violently back by an electric shock as soon as he attempted to remove a knit jacket. He soon recovered and continued his work only to receive an additional shock which scorched his hand. The attention of bystanders was excited, and it was found that brilliant flashes of light could be drawn from the iron front of the store. On investigation it was found that an electric light wire had come in contact with the wet awning, and thus had caused the trouble. Here at least is a case where it would be hard for the electric light company to plead contributory negligence.

The Eclipse of the Sun, January 1.

The weather conditions for making good observations seem to have been almost perfect along the line of the total eclipse of the sun, through northern California and Nevada obliquely up through Manitoba, on the first day of the year. Extensive preparations had been made for this work, and a great number of good photographs of the sun's corona have been obtained. Prof. Pickering, chief of the eclipse expedition which had been sent out by Harvard College, telegraphs that their apparatus worked finely, that the corona exhibited great details in its filaments, and that between fifty and sixty photographic negatives were obtained with their telescopes and spectroscopes, eight negatives of the corona being with the great thirteen inch refracting telescope. It is said that a striking characteristic of the corona was two forked wings of light polar rays, well defined. Seven photometric observations were made of the light of the corona during a duration of totality of 118 seconds, the drawings showing that the corona extended outward from the sun two millions of miles. A large and successful party of amateur photographers and astronomers made observations at Cloverdale, Sonoma County. Besides numerous cameras, the observers were equipped with reflectors from Chabot University and a sidereal clock set to automatically record the time. The first contact here occurred at 12:23 P. M., and at 12:46:35 P. M. the corona on the western limb was visible. In from 5 to 7 seconds after, the eclipse was total, totality lasting 104 seconds. The Amateur Photographers' Association took 187 negatives of the corona at different times and with different lengths of exposure. These will be turned over to the Lick Observatory, and the results published as soon as possible. At the Lick Observatory, Professor Holden took thirteen photographs, the sky being cloudy there a portion of the time of the eclipse, and the Lick observing party, under Prof. J. F. Keeler, at Bartlett Springs, Cal., reports having done successful work. Other good work was also done at various points in Nevada and Montana, and at Brandon, a central point in the province of Manitoba. At this point the first contact was observed at 3:15:34 P. M., but the time of the last contact could not be taken, as the sun and moon passed below the horizon together.

Completion of the Great Steel Bridge over the Hudson River at Poughkeepsie, N. Y.

The first engine and car passed over the Poughkeepsie Bridge on December 29 last, when connection with the New York and Massachusetts Railroad was made, the train being in charge of John W. Brock, of Philadelphia, the president of the Manhattan Bridge Building Company. Col. P. P. Dickinson, chief engineer of the Poughkeepsie Bridge Company, who was one of the original projectors of the enterprise and has been connected with it from the first, ran the engine. Among those on board were Charles Cossum, assistant superintendent of the New York Central and Hudson River Railroad; George P. Pelton, president of the New York and Massachusetts Railroad; the Hon. John T. Platt, vice-president of the Poughkeepsie Bridge Company; the Hon. Homer A. Nelson, Hudson Taylor, C. C. Gaines, John F. O'Rourke, engineer of the Union Bridge Company; James B. Platt, C. E. Fogg, J. W. Hinkley, and others.

When the train was seen slowly passing up the east approach, it was greeted by a salute from every part of the city and along the river front on both shores, and multitudes of people gathered to see it cross.

The bridge is of steel, on the cantilever system. There are five river spans, varying from 500 to 521 feet 6 inches each, with head room of from 130 to 160 feet, and two shore spans of 201 feet each. The four river piers are quite narrow, only 25 feet wide. The foundations are 130 feet deep. The cost has been about $2,500,000.

This bridge affords a direct communication between Boston and the regions of New England and the coal mines of Pennsylvania. Illustrations and particulars of this great work are contained in our SUPPLEMENT, No. 646.

New American and British War Vessels.

We publish this week accounts of two new war ships. Of one, the Australia, recently completed in England, we give an engraving. Of the American ship, not yet named and not yet begun, we give a description. The United States vessel is to have a displacement of 4,000 tons and 14½ feet draught; the British ship, 5,000 tons displacement and 19 feet draught. The United States boat is to be a slow tub as to speed, engine power being 5,400 horse power, against 9,200 of the Australia. The armament of the American ship will be the heaviest of any vessel in our navy.

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A New War Ship for the U. S. Navy.

The plans for the steel-clad war ship which have just been completed are in several respects among the most novel and interesting of the various designs adopted for our new fleet. In point of size, it is true, she will be surpassed by several of the new vessels. She is to have only about 4,000 tons displacement, while the Maine will displace 6,648 tons; the Texas, even if her original dimensions are adhered to, 6,300; the Puritan, launched many years ago, 6,060; the new armored cruiser provided for at the last session of Congress, 7,500, or nearly double as much as the present coast defense vessel. She will even be surpassed in displacement by the unarmored vessels Chicago, Baltimore, Philadelphia, and the new twenty-knot cruiser, and equaled or surpassed by the Newark and San Francisco. In speed, also, she is not expected to come up to the three new armored cruisers, and while her 5,400 indicated horse power will be quite enough for her purpose, considering her size, it does not look large compared with the 8,000 to be furnished to the Texas and the 9,000 to the Maine. Nevertheless, in the important features of armor and armament she aims at a high standard.

The new vessel adopts the low freeboard principle of the original monitor, thereby securing the possibility of great thickness of armor with comparatively small displacement. She is 250 feet in length between perpendiculars, 59 in extreme breadth, and 14½ in mean draught. Her hull, which has water-tight compartments and a double bottom, is protected by a belt of steel armor sixteen inches thick over the vital parts, which becomes six and eight inches at the extreme ends. This maximum thickness of armor is greater than any yet contemplated on any of our war vessels, and it avails for still greater protection in a vessel of this type, low in the water, and offering a difficult target to the enemy. The armored deck is also three inches thick over the magazines and machinery, and two inches at the ends. The conning tower has ten inches of armor, and the base of the smoke-stack six inches. The bow is strengthened for ramming.

But the armament is still more noticeable. The main battery will have in a forward barbette a 16-inch 110-ton breech-loading rifle, and in the aft barbette a 12-inch 46-ton breech-loading rifle, while a third weapon will be a 16-inch dynamite tube at the bow. The largest gun we now have afloat is the 8-inch, which weighs about 38,000 pounds, and throws a projectile of 250 pounds with about half that weight of powder charge. But the 16-inch rifle, according to the calculations of naval experts, would weigh from 107 to 110 tons, and would throw a projectile of 1,800 to 2,000 pounds with a powder charge of 900 to 1,000 pounds. It is true that several of the other new vessels are to be supplied with 10-inch and 12-inch rifles; but even the latter will weigh only from 44 to 46 tons, and will throw a projectile of 850 pounds with a powder charge of 425. The new coast defense vessel will go at once to the extreme limit of modern heavy ordnance, and will be armed with a gun equal to any now carried by the prodigious vessels of Italy and England. It is true that she will have but one gun of this caliber, while some of the European iron-clads carry four. But she will have a displacement of only 4,000 tons against the 10,600 of the Benbow and the 13,900 of the Italia.

These are the features which give its chief interest and prospective value to the new coast defense ship. The others will be such as the advanced methods of naval construction warrant. Her secondary battery will include fifteen rapid-fire guns of various calibers. Her military mast will be used for signaling, while machine guns and a search light will be placed in the tops. The steering gear, electrical apparatus, and other arrangements will be of the most approved types. This vessel has been the subject of long deliberation, the act of Congress which allowed $2,000,000 to be expended for "floating batteries, rams, or other naval structures" for harbor defense, having been passed nearly two years ago. The result of this deliberation has been at least to secure something quite out of the beaten track of naval designing.—*N. Y. Times.*

SOME INTERESTING OBSERVATIONS OF JUPITER.

During the summer of 1888 I made a good many observations of Jupiter and his satellites and accompanying phenomena. Some of these will, I think, prove of interest to the readers of the SCIENTIFIC AMERICAN. The rapid motion of the satellites around Jupiter causes this wonderful system to present an ever-changing celestial picture of exceeding beauty and interest, when viewed through a powerful telescope. During August, 1888, Jupiter passed very close to several telescopic stars of about the same magnitude as the satellites, so that on one occasion Jupiter presented the remarkable appearance of having *five* moons, and on another evening *six moons.*

Again, on the evening of August 7, there was almost an occultation of a star by Jupiter. This star was first noticed by me on the evening of July 23, when it was about half a degree east of Jupiter, and next on the evening of July 30, in a low power telescopic field. Jupiter and his moons, with the star, presented the arrangement shown in Fig. 1. It must be understood that this is the inverted telescopic view. Jupiter's motion, also appearing reversed, is eastward, as shown by the arrow, and toward the star.

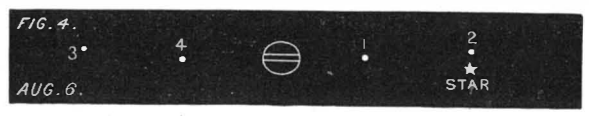
The moons are numbered in the order of their real distances from the planet in all the views, their names being as follows—No. 1 being the nearest to Jupiter:

No. 1. Io.
No. 2. Europa.
No. 3. Ganymede.
No. 4. Callisto.

On the evening of August 2 the moons had so changed their position as to present the appearance shown in Fig. 2. All the moons were on the same side of Jupiter and in a line with the star. The star appeared to be of the same magnitude as satellite 3 (Ganymede), and Jupiter really seemed to be attended by *five* moons.

Fig. 3 presents the interesting configuration of the moons, Jupiter, and the star on the evening of August 4, at 9 o'clock. The change of positions compared with the previous evening is very marked, and the nearer approach of Jupiter to the star very noticeable. The mean of seven measurements with a bar micrometer made the star's place twenty-two and two-tenths seconds of time east of the following limb of Jupiter. The star appeared considerably fainter than satellite 4, Callisto, on this occasion, when farther off it had appeared much brighter.

On the evening of August 6, the appearance was that shown in Fig. 4. The star was just under and very close to satellite 2, Europa, and presented the appearance of a wide double star.



The brightness of the star was only about one-half that of Europa. Micrometer measurements made the star eleven seconds of time east of the following limb of Jupiter on this occasion. The star seemed more than ever to be a part of Jupiter's system, and the whole was a beautiful telescopic picture. The advancing motion of Jupiter upon the star is now very noticeable, and it seems likely that the planet will occult the star.

The star just grazed the lower edge of Jupiter on the evening of August 7, as shown in Fig. 5. The star looked very small and faint in contrast with the superior brilliancy of Jupiter. Only three of the satellites were visible on this occasion, Europa being in transit.

Fig. 6 gives the relative positions the following evening, August 8, when Jupiter had passed to the east of the star. The latter was near the satellite 2, Europa. Three moons only were visible this evening, No. 1 being in transit.

In Fig. 7 I give the appearance of Jupiter's system on the evening of September 11, when all the moons were visible in the order shown, and also a neat double star, so that Jupiter on this occasion presented the remarkable appearance of being attended by no less than *six* satellites.

The observation and study of these grand orbs and their complex motions is most interesting and valuable.

WILLIAM R. BROOKS.

Smith Observatory, Geneva, N. Y., Dec. 28, 1888.

Live Men.

Some men seem never to grow old. Always active in thought, always ready to adopt new ideas, they are never chargeable with fogyism. Satisfied yet ever dissatisfied, settled yet ever unsettled, they always enjoy the best of what is and are the first to find the best of what will be.—*Philadelphia Inquirer.*

A Sugar Refining Deception.

An alleged wonderful discovery, by which raw sugar was almost instantly refined by electricity, the product being a refined sugar of remarkable purity, has for some time past been used to dupe foolish capitalists. It was said the process was non-patentable, and therefore everything about it was kept, in regular Keely style, a profound secret, under lock and key. Only the projector and alleged discoverer of this method of refining were ever allowed to enter the rooms where the work was carried on. And on this basis a company was formed, about $1,000,000 worth of stock sold, for a secret process of refining sugar of which it was said even the great sugar trust, representing all the great refineries, were becoming apprehensive. It now turns out that the whole thing was only an amazing swindle. The projector had at his house, or elsewhere, chemically treated the best refined sugar in the market, so as to make the most pure product possible, in cubes, and had succeeded in introducing tons of this sugar, instead of raw sugar, into the secret room of his factory. In this room he had only the ordinary crushing machinery, of which the outsiders heard the working, and saw the stream of very fine sugar coming out of a spout in another room. And on this they expended their money.

A Million Dollar Telescope.

Representative Butler, of Tennessee, has introduced a bill in Congress to appropriate $1,000,000 to be expended, under the direction of the Secretary of the Navy, in the construction of a great telescope with a lens 60 inches, or 5 feet, in diameter. The diameter of the Lick object glass, the largest in the world, is 36 inches. In view of the fact that many astronomers regarded the success of the great Californian telescope as more than problematical, on account of the difficulty of casting and figuring such huge disks of glass, Mr. Butler's proposition is decidedly startling. But it should be remembered that, thanks to the success of the Paris glass makers and the incomparable skill of our great American telescope makers, the Clarks, the Lick lens has turned out to be so perfect that the croakers have been silenced, and wonder has taken the place of doubt. While it would undoubtedly be an achievement that would tax to the utmost the skill and experience of the artisans and artists who should undertake the work, yet it cannot be said that the construction of a telescopic object glass of 60 inches diameter is impossible.

Such a glass, if successfully made, would be a much greater improvement over the Lick telescope than that great instrument was over the largest of its predecessors. To show this it is only necessary to remember that the light-gathering power of an object glass varies as the square of its diameter. The largest glass before the completion of the Lick lens was the 30 inch telescope of the observatory of Pulkowa. The light-gathering power of the Lick telescope is to that at Pulkowa about as 13 to 9, or one and a half times as great; but the power of a 60 inch lens would be to that of the Lick telescope as 36 to 13, or nearly three times as great. Such a glass would be four times as powerful as the Pulkowa telescope.—*N. Y. Sun.*

Photo. Transparencies.

After fixing the positive, wash it very thoroughly—say for at least an hour—in a constantly changing stream of water, and a final treatment with hydroxyl or one of the hypochlorites in very dilute solution will not be a disadvantage. A solution composed of twenty grains each of chloride of mercury and chloride of ammonium in an ounce of water is next applied, until the image is uniformly whitened throughout its whole thickness, as judged by its appearance from the back of the glass. After that another very thorough washing is necessary, either in a constantly changing stream, or else, after some three or four minutes under a tap, a long soaking of, at least, half an hour, or preferably longer. The washing at this stage cannot be too complete.

Next, for the toning solution. This consists of a solution of moderate strength—say, twenty to fifty grains to the ounce—of sulphide of potassium or "liver of sulphur," the application of which is continued until the desired depth of tint is attained. Potassium sulphide is not a particularly desirable adjunct to the dark room on account of its offensive smell, but so long as there is no sensitive paper, carbon tissue, or similar delicate matter lying about, the inconvenience will end with the smell.

The tones produced under this treatment are of the most pleasing character, ranging through various shades of purple, and are quite independent of the color or character of the image before bleaching. But it must be borne in mind that the final color, after drying, is colder or verges more toward blue than when the picture is wet. This borne in mind, and with a little experience in judging the point at which to stop, no difficulty will be experienced in getting uniform and pleasing tones for transparencies on any good plates.—*Br. Jour. Photo.*

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THE STRONG LOCOMOTIVE.

(*Continued from first page.*)

service, as higher pressures can be carried than with the old style flat-sided structures. They have co-operated with the compound engine to bring down the coal consumption to the very low point it has now attained in good practice. Its introduction on a locomotive is a step in the right direction, comparable to compounding the cylinders.

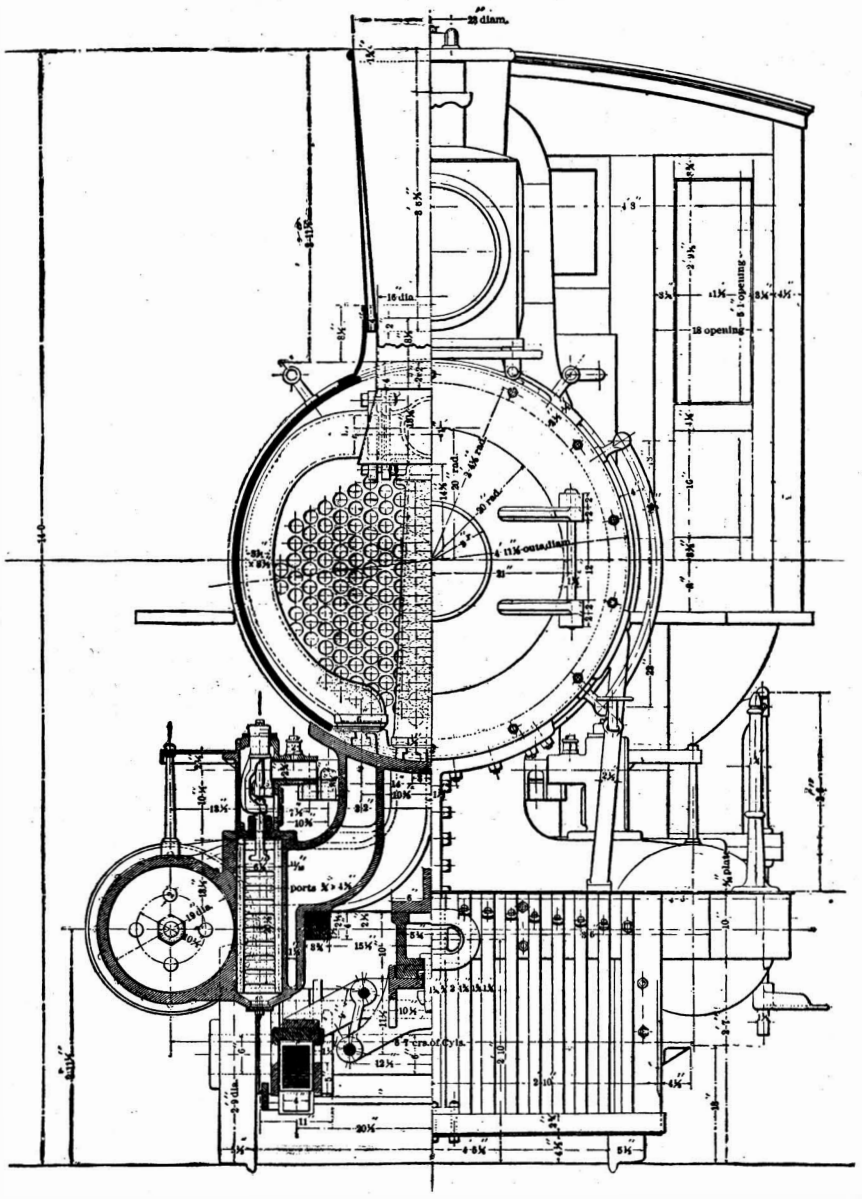
By its peculiar valve, the Strong engine is supposed to do away with the necessity for this last step. They are of such large port-area that a very sharply defined cut-off can be obtained. There is no steam chest, but each cylinder is fitted with four valves, two exhaust and two steam valves. They are of gridiron type. The steam valve has ten parallel openings, each 4⅝ inches long, giving a total port length of nearly four feet (46¼ inches). The four valves are worked by a single eccentric, so that the usual link motion is not used. It is impossible to fully describe the details here. The general action is slow at the beginning of the movement until the cushioning of the exhaust end of the cylinder relieves the pressure, when the valve quickly completes its travel. This avoids much of the friction of valve motion, something which has proved a very serious source of loss of power in ordinary engines.

When the engine is working at 250 revolutions per minute, it is claimed that the initial cylinder pressure will be within two pounds of the boiler pressure. When all is in perfect adjustment, it can readily be seen that excellent results should be obtained. The small extent of valve travel, about 1 1/16 in., together with the large port-area, about 48 sq. in., is the cause of this perfection of action. Against it, however, the point has been made that the least amount of lost motion would seriously affect its work. Yet it seems clear that it would be well worth while to watch the valve gear closely, and keep it in condition to avoid such defects, when it is remembered how much good is involved in its details.

Its general dimensions are as follows:

Cylinders, 19 in. diam. by 24 in. stroke.	
Driving wheels, 68 in. diam.	
Total weight of engine with boiler full and coal on grates	138,000 lb.
Weight on both pairs of drivers	72,000 "
Weight on forward truck	34,000 "
Weight on trailing wheels	32,000 "
Grate surface	30 sq. ft.
Heating surface	1,650 "
Working pressure of steam	160 lb.
Wheel base of drivers	7 ft.
Total wheel base	29 "
Height above track, clearing everything	14 "
Total length of boiler	31 ft. ⅝ in.

It will be noticed that the engine has two cabs. A speaking tube is provided for communication between the fireman and engineer.



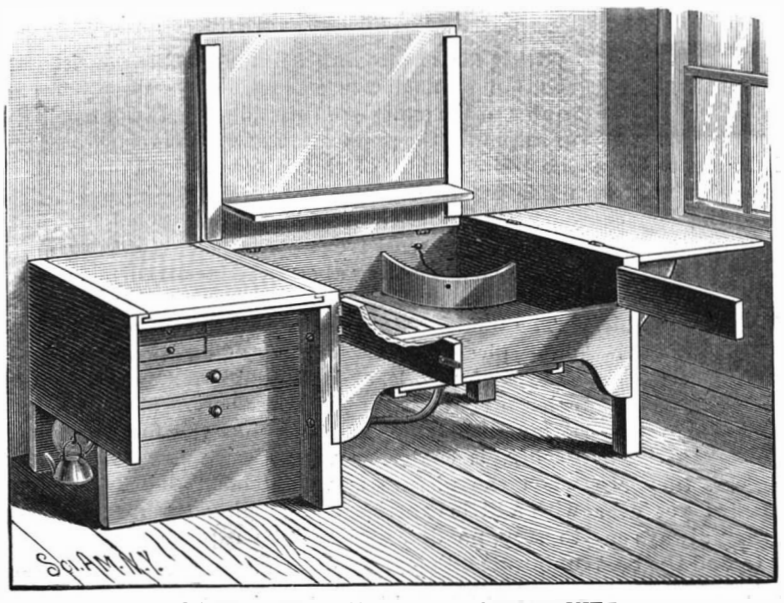
SECTION THROUGH CENTER OF TRUCK AND FRONT INLET VALVE OF CYLINDER.

FRONT END ELEVATION.

TRANSVERSE SECTION OF ENGINE SHOWING STEAM VALVE.

IMPROVED KITCHEN TABLE AND CABINET.

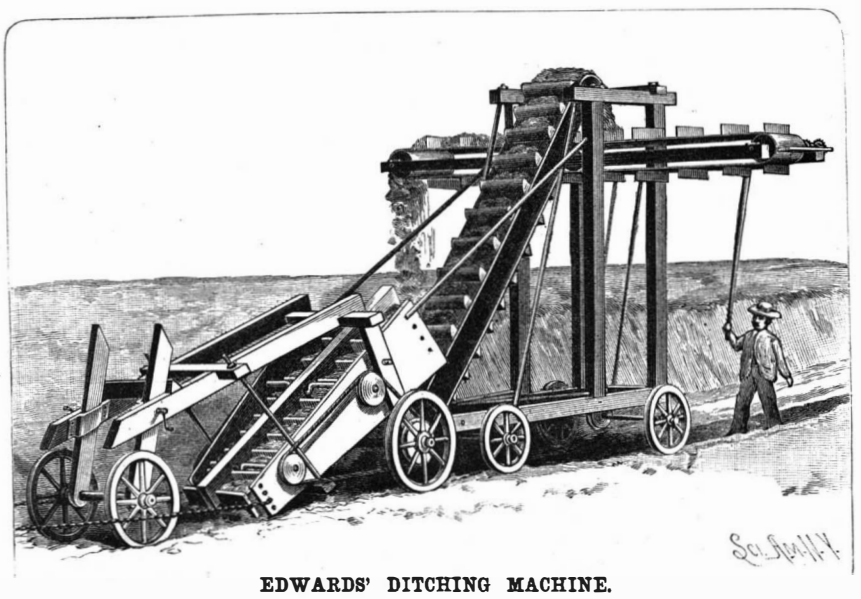
The construction shown in the accompanying representation differs in many points from previous inventions in this department, the table and sink themselves constituting the greater essentials, and not being minor to details of less consequence. The body proper is composed of a table in two heights, the opened front showing the lower portion, at which a child may stand or a chair be placed when desired. Inside there is a compartment or basin, in which dishes may be washed, with a water outlet, and a space for the common pan for rinsing. The open doors also constitute a towel rack, and the whole, when closed, makes a convenient receptacle for unclean dishes. The main portion, constituting a table when its cover is down, may be elaborated by adding a leaf to one or both ends, and under one of these, itself a bread board when inverted, is a cabinet, as shown in the cut; otherwise, two large bins may be placed under one leaf, and drawers under the other, leaving spaces for hooks, where iron vessels may be kept out of sight. Shelves may also be attached to brackets upon the leaves. The whole is made in parts attached by screws, and the legs are adjustable. The essentials and adjuncts are thus, with this construction, brought readily within the reach of a person in one position, the whole being economically made, and suited to stand in the dining room as well as the kitchen of numerous households. For further particulars with reference to this invention, address the patentee, Mrs. Mary S. Brack, No. 912 North Oregon Street, El Paso, Texas.



BRACK'S KITCHEN TABLE AND CABINET.

AN IMPROVED DITCHING MACHINE.

The accompanying illustration represents a machine for digging ditches or trenches of any desired depth or width for irrigation, drainage, or pipe laying, or for making earth fences, etc. It has been patented by Mr. Charles C. Edwards, of Amorillo, Texas. The scoop is held between uprights of the digger frame, the draught being applied by hooking chains into holes in the forward parts of the sides of the scoop, and the body of the scoop resting upon a crossbar hung by bolts from the upper crossbar of the digger frame, screw nuts on these bolts providing for the regulation of the height of the nose of the scoop to a limited extent. Set screws in the side bars of the frame provide for locking the front wheel frame at the keepers at any required height relatively to the scoop, thus allowing the forward wheels to be set higher or lower, as the scoop is to cut deeper or shallower in the earth, according to the nature of the ground or the amount of power employed. Within the scoop is hung, by two crank shafts, an earth conveyer, which is reciprocated by the cranks of the shafts, so as to carry the earth dug by the nose of the scoop up its inclined bottom, discharging the earth from the upper rear end of the scoop on the front of an elevator carrier. The digger and carrier may be readily separated, to allow connection of another digger, which will cut a deeper ditch, and this separable connection promotes convenience in housing the apparatus when not in use.



EDWARDS' DITCHING MACHINE.

The elevator consists of an endless belt, with buckets, which runs over upper and lower rollers on the carrier frame, traveling behind the digger. The uprights of this carrier frame also support a pair of laterally ranging timbers forming supports for a laterally traveling endless earth-discharge belt. The elevator belt is operated automatically by gear wheels on the front axle of the carrier truck, as the carrier is drawn forward, and the laterally traveling discharge belt is similarly operated by means of bevel gear and a belt running on a pulley fast to the rear axle of the carrier frame. With this construction, as the machine is drawn forward, the earth cut by the scoop is carried by the conveyer hung therein and dropped into the buckets of the elevator, which carries it upward and discharges it upon the endless belt of the laterally traveling carrier, which may be operated in either direction to discharge the earth to either side of the ditch cut by the machine.

How Much Current to Kill an Elephant?

Many who saw or heard of the experiments made with alternating electrical light currents at the Edison laboratory, to find a substitute for hanging, will regret that the big elephant Chief, of Forepaugh's circus, sentenced to death for his viciousness, could not have been experimented with, as was promised. It is the skin which gives the strongest resistance to the passage of the current, and though animals are far more vulnerable than men, yet there was reason to believe that it would not have been an easy task. Just where the electrodes should have been placed would have been an interesting study. With one pole at the apex of the heart, and the other at the neck, where it would reach the phrenic nerve, dogs have been found to readily succumb. But would the 3,000 volts current, which, we are told, will surely kill a man—they have been killed with far less than this—be enough to dull the consciousness of an elephant and then kill? It seems the circus people could not wait for the elaborate preparations necessary. They tied a noose around Chief's neck, and giving an end each to two other elephants, started them tugging in opposite directions till the big elephant was dead.

THE largest railway station in the world is the one inaugurated at Frankfort-on-the-Main, on the 18th of August. It covers a superficies of 335,916 square feet. Hitherto, the largest stations have been the Saint Pancras at London (166,625 square feet) and the Silesia station at Berlin (130,000 square feet). That of Frankfort is double the size of the first named.—*La Semaine des Constructeurs.*

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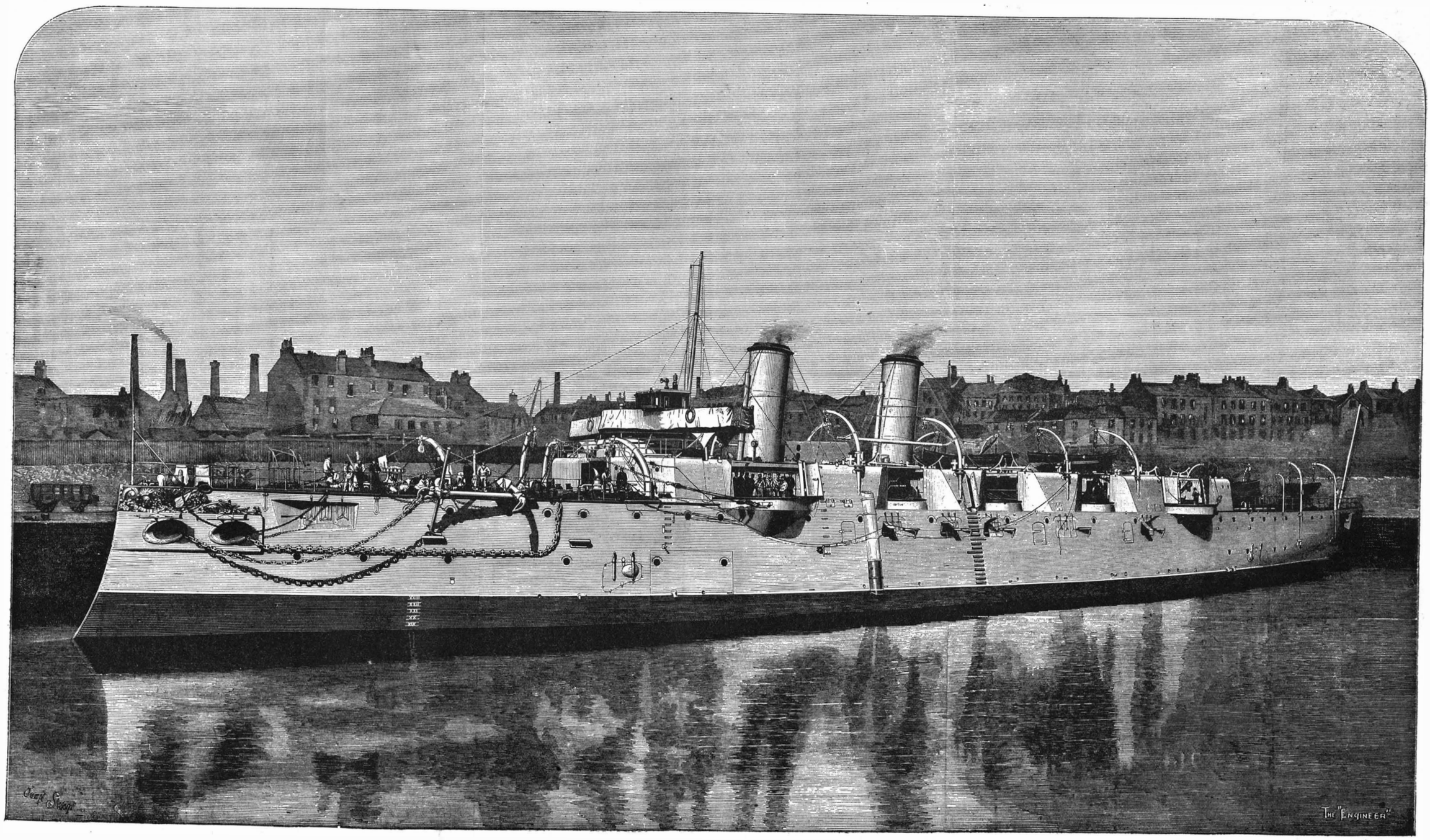
THE NEW BRITISH ARMORED WAR SHIP AUSTRALIA.

We illustrate one of the most recent additions to the British navy—we might almost say two, for the drawing would serve indifferently for either of the sister ships Australia or Galatea.

H. M. S. Australia and Galatea, built and engined by Messrs. R. Napier & Sons, Glasgow, belong, says the *Engineer*, to the class of swift and powerfully armed belted cruisers, specially designed for the protection of our national commerce. Their principal dimensions are: Length between perpendiculars, 300 ft.; breadth, extreme, 56 ft.; depth, moulded, 37 ft.; with a displacement of 5,000 tons at 19 ft. draught when in the normal fighting condition, but this may be increased to 6,000 tons when an extra supply of coal is shipped. The belt which protects the water-line for two-thirds of the length consists of steel-faced compound armor 10 in. thick, strongly supported by steel and teakwood backing, and terminates at each end in an athwartship iron bulkhead 16 in. thick to stop end-on shot. Level with the top of the armor belt is a protective steel deck, 2 in. thick on the flat and 3 in. on the angle where it slopes down below the water-line, and this deck also extends to the stem and stern respectively. All the machinery of vital importance, including the steering gear, air compressors, electric dynamos, etc., is placed under the



THE NEW BRITISH ARMORED CRUISER AUSTRALIA—5,000 TONS, 9,400 HORSE POWER.

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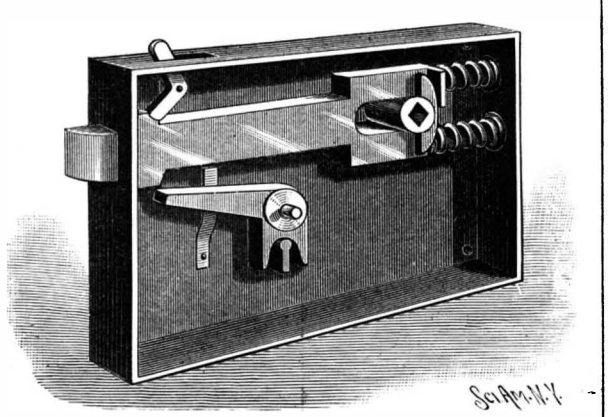
protective deck, while above it, for the length of the engine and boiler rooms, the sides are defended by coal, and an armor-plated conning tower on the upper deck is fitted with steering gear, telegraphs, etc., for working the ship when in action. While every precaution is thus taken to keep out shot and shell, the buoyancy in case of penetration is insured by the minute subdivision of the underwater portion of the hull, which contains upward of 130 separate water-tight cells and compartments. The armament consists of two long range 22 ton breech-loading guns and central pivot mountings on the upper deck, forward and aft respectively; ten 6 in. guns similarly mounted on the broadside; eight 6 pounder and eight 3 pounder quick-firing guns, also six torpedo tubes. The engines, which were designed by Mr. A. C. Kirk, the senior partner of Messrs. Napier's firm, were originally specified by the Admiralty to be of the ordinary compound type for 7,500 horse power; but from their previous experience, Messrs. Napier were able to show that by substituting triple expansion engines they could guarantee an increase of 1,000 horse power, and almost a knot more speed, thereby enormously increasing the value of the ship as a fighting machine, without adding to the total weight of machinery and coal, or occupying more space. This suggestion was eventually adopted by the Admiralty and also carried out in the other ships of the class.

The two sets of engines are of the three-crank horizontal type, working twin screws, and are placed one before the other in separate watertight compartments, the cylinders being 36 inches + 51 inches + 77 inches by 44 inches, and steam is supplied by four double-ended boilers, of the return tube type, which are placed forward of the engines in two independent stokeholds divided by water-tight bulkheads. The results of the official trials were highly satisfactory, and fully justified the contractors' proposal to introduce the triple expansion engines.

In the case of the Galatea, the collective horse power on the four hours' forced draught trial was 9,204, being more than 700 horse power in excess of the contract. The highest power developed during any single half hour was 9,665 horses, and the mean of the last three hours gave 9,415, equal to 1,915 I. H. P. above what was originally proposed by the Admiralty. This splendid result was attained on a consumption of 1·97 pounds of coal per I. H. P. per hour with an air pressure in the stokeholds of only 1¼ inches, and that while working as pure triple expansion engines, without passing boiler steam into the receivers, and the steam was supplied in such abundance that with the engines working at their maximum there was a constant blow-off.

AN IMPROVED LATCH AND LOCK.

The accompanying illustration represents a combined latch and lock wherein the latch may be manipulated only from the knob spindle, while two locking levers are employed to hold the latch in a locked position. This invention has been patented by Mr. Henry Kendall, of Xenia, Ohio. The latch has the usual beveled outer face, lugs projecting from its opposite sides engaging the inner face of the lock casing, against which they are normally held by two spiral springs attached to the rear end of the latch, and having a bearing on the inner end of the lock casing. Near the rear end of the latch is a longitudinal slot through which passes the knob spindle, having the usual follower, adapted to engage prongs on the end of the latch, these prongs permitting of the latch being reversed for attachment to the door opening either to the right or the left. An angular thumb piece is pivoted to project through a slot in the upper side and near



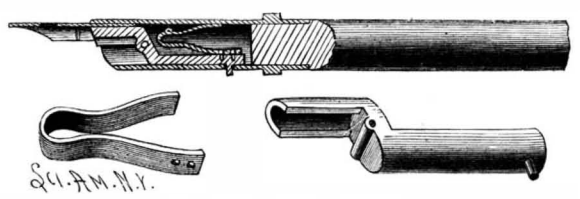
KENDALL'S LATCH AND LOCK.

the front of the lock casing, the lower member of this thumb piece being adapted to engage one of the lugs upon the latch, to prevent its being moved by the turning of the knob spindle.

An auxiliary angular locking bolt is pivoted below the latch, and adapted to engage the lug upon its under side, a member of this locking bolt partially encompassing the key opening. With this construction the latch can only be drawn inward by means of the knob spindle, but it may be locked in outer position by means of the thumb latch piece or by the key-operated locking bolt, either one or both of which may be employed to this end.

AN IMPROVED PEN HOLDER.

The illustration herewith shows a penholder patented by Mr. Fernand B. Poupart, and designed to hold the pen in its place by means of a spring clamp, which can be readily released when desired. A spring-actuated lever, as shown in one of the small views, is pivoted in the holder, the long arm of the lever having an outwardly projecting pin, opposite which, and bearing against the lever and the inner side of the casing, a spring is attached. The spring operates to hold the short arm of the lever firmly against the pen, but this hold can be readily released for the removal of the pen by pressing upon the pin.



POUPART'S PEN HOLDER.

For further information relative to this invention address Mr. Samuel Gautier, Lock Box No. 16, New Orleans, La.

Handling of Acids.

A correspondent informs us that he has met with a serious accident, caused by the spattering of some drops of muriatic acid into his eyes, while loosening the glass stopper of a five pint bottle containing it. He suggests that we caution our readers against similar mishaps, and he thinks that it would be a useful thing to repeat such cautions occasionally, even without waiting for the occurrence of an accident. We think this suggestion deserves attention, and, in compliance, will append here some cautionary remarks, which do not claim to embrace all that could be written upon the subject, but which may afford some practical hints at least for the younger and less experienced members of the profession.

When emptying *carboys* of acid, see that they are securely held. Do not tilt them over with one hand, while holding a receiving vessel in the other, unless they are so hung or placed that you have absolute control over them. A good way is to put the carboy on an elevated place, say about 18 to 24 inches high, so that when it lies on its side, its upper edge will be about three inches within the edge of the platform. If the carboy has a wooden strip or side rail, instead of a handle, it is best to tilt it on the side where this is situated, as this assists in keeping command over the carboy while it is tilted. If you have a carboy swing, be sure you see that the carboy is securely fastened, and that allowance be made for the change in center of gravity as it becomes more empty.

Never stand in front of a carboy while emptying it, but sideways, and use a receiving vessel with a substantial handle. Do not hold a bottle with a funnel under the mouth of the carboy, nor hold any vessel so that if it should overflow, the acid would run over your hands.

Choose such a place for emptying carboys, or any other containers of acid, as will suffer the least injury should the vessel be broken, or any of the acid be spilled.

Remember that the larger or the flimsier the container is, the more care and circumspection must be exercised. A person may have emptied a hundred or more carboys without any mishap, when unexpectedly an accident will happen, and in nine cases out of ten this is due to pure carelessness.

Never carry large containers of acid in contact with your body. Should they accidentally break, a most painful burn (sometimes turning out fatally) may be the result.

When opening acid bottles, for instance, the usual five pint sizes, first remove the cement from around the stopper, and wash and wipe the neck carefully to remove every trace of foreign matter. Then, if the stopper cannot be easily loosened by hand, place a coarse towel over the stopper and bottle, and while bearing with the thumb of one hand against the edge of one side of the stopper, tap the other side gently with the wooden (*not* metallic) handle of a spatula, when it usually will become loose. Should it be very obstinate, and the bottle at the same time appear to be of rather thin glass, place the bottle into a sufficiently deep and large acid-proof jar to receive the contents in case the bottle should break. The reason why a towel should be put over the stopper is almost self-evident. Our correspondent would have had no occasion to write to us had he used one. If a bottle of acid is exposed to a warm temperature, evidently some pressure will be developed within the bottle. By moving the bottle about, the neck and bottom of the stopper will be wetted with the acid, and if afterward the stopper is suddenly loosened, the compressed air or gases will throw out any particles of liquid which are between the neck and stopper.

All acids are not equally dangerous. Hydrochloric or muriatic is perhaps the least risky. Sulphuric acid comes next, as it does not evolve any gases. The greatest care, however, must be exercised with nitric acid, and still more so with aqua regia.

When compelled to work for any length of time with acids, it is well to have a vessel of fresh water close at hand, to wash off any drops that may have come in contact with the hands or face. Sometimes it may be advantageous to wear India rubber gloves, though most of those sold for this purpose are rather clumsy.

In packing acids, it should be made a rule to put them in a box by themselves, if at all possible. It would certainly be dangerous to pack sulphuric acid promiscuously with such articles as chlorate of potassium and organic substances.

In storing acids, equal care must be exercised. As a rule, they should be kept in a place so arranged that, if the containers should be broken, the acid would be unable to reach other substances.

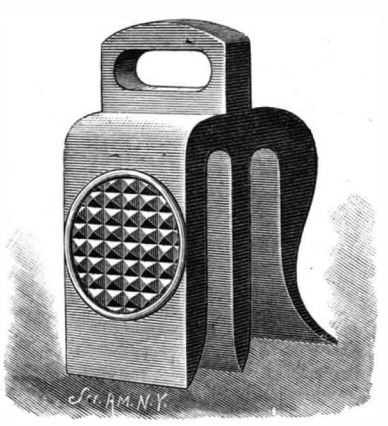
When diluting acids with water, remember always to pour the acid, gradually and under stirring, *into the water*, and not the water in the acid. In the case of sulphuric acid, for instance, the latter method may develop such an amount of steam at once that the whole liquid may be scattered about and do much damage. The last time we saw this happen was about a year ago, when several carboys of acid accidentally fell from the rear end of a truck in front of a factory of mineral waters. The acid collected in a pool in the gutter, and one of the workmen connected with the establishment, wanting to wash it into the sewer, turned a small stream of water upon it by means of a hose. The consequence was, a violent evolution of steam, almost resembling an explosion, and a number of the bystanders received more or less of the spray, to the damage of their skin and clothes.—*American Druggist.*

Gas and Electric Engines in the Lamp Posts.

M. G. A. Tabourin proposes to the Paris Municipal Council to fit each lamp post with arc light dynamo and gas engine. He has contrived a dynamo of minute parts and a gas engine ten inches in diameter for coupling up with it, and would put a dynamo and gas engine in the post under each of the gas lamps, as used at present in that city, utilizing the gas supply for feeding the gas engine. He shows by tables of cost and quantity, which he says are correct, that far more light, in the form of electricity, can be had by the use of this product of coal applied to the dynamo than when the gas is directly used for light. Then he sets out to show that the cost of apparatus would not be as large as, at the first blush, it would seem, and, considering the price paid per arc light per year, not costly; far less so than the Jablochkoff candle installation in l'Avenue de l'Opera some years ago. Should his scheme prove practicable, we might be enabled to give up the discussion of burying wires, so far as high tension currents are concerned, for it would not require any.

AN IMPROVED BUTTER WORKER.

A cheap and simple butter worker, adapted to puncture the butter so that salt may be introduced and buttermilk extracted, and also suitable for cutting the butter into desired portions, moulding it into balls, and stamping, is illustrated herewith, and has been patented by Mrs. Julia A. Graves, of Fair Haven, Vt. The device is preferably formed of a single piece of wood, made into a handle with three blades of approximately equal length, arranged side by side, one of the outer



GRAVES' BUTTER WORKER.

blades being concaved on its outer side. The other straight blade has a stamp on its outer side with which to stamp the butter.

Going with the Times.

"Professor, what are your views concerning the schools of medicine and theology?" Professor: "That depends upon circumstances. When I am slightly ill, I am a homeopathist and a Unitarian; but when I am very sick, I am an allopathist and a Calvinist."

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Correspondence.

Inaudible Sounds Made Audible.

To the Editor of the Scientific American:

The phonograph would record sounds too high to be heard by man. By reproducing the sound at a lower speed of the instrument, the pitch could be lowered to any extent necessary, so that we could hear them.

S. P. GARY.

Oshkosh, Wis.

Calculating Capacity of Cisterns.

To the Editor of the Scientific American:

Using Mr. Melzer's example in his communication in your issue of December 15, why does he use the following: 300 inches×300 inches×0·0408=3672 U. S. gallons?

Rule.—Square the diameter of cylinder in inches, and multiply by 0·0408=gallons per foot.

SUBSCRIBER.

Rockford, Ill.

Interest Problem in Query 22 of December 15, 1888.

To the Editor of the Scientific American:

Is there not an error in answer 22 of your issue of December 15, 1888? It seems to me that the equation should be $200+x-0{\cdot}08x=500$, and that no interest is to be added to x, when found, as it was paid in advance by the terms of the problem. T. B. A.

Hightstown, N. J.

[By a typographical error the multiplication sign (×) was used in our equation for the plus sign (+). Your equation gives the same solution as ours. Interest is certainly to be added, not to x, but to $500-x$, as the holder of the claim does not by any terms expressed in the problem forfeit his interest on the portion of the capital which is included in the payment of $200. Interest was paid in advance on the unpaid part only.—ED.]

Wet and Dry Air.

To the Editor of the Scientific American:

I would call your attention to question 36, on page 347, where Mr. W. McP. asks: "Before a rain the atmosphere contains moisture. The atmosphere and moisture weigh more than the atmosphere alone."

You fail in properly answering this question. Your correspondent is laboring under a misapprehension as to the real condition, dry air being heavier than that which is saturated with moisture. See table 17, page 181, of Guyot's Meteorological and Physical Tables, 1884, Smithsonian issue.

Temperature Fahrenheit.	Weight of a cubic foot of dry air in grains.	Weight of a cubic foot of saturated air.	Excess dry air.
0°	603·21 grains.	602·77 grains.	0·44 grs.
32°	563· "	561·64 "	1·36 "
60°	531·97 "	528·62 "	3·35 "
90°	502·32 "	494 28 "	8·04 "

The above shows clearly the true difference.

J. LESLIE CORBETT.

Butte City, Montana.

[We did answer the question properly. Before a rain the atmosphere may be dry or humid, and the specific gravity of the air in many cases has nothing to do with the question of the barometric height. If our readers do not know that dry air is heavier than wet air, it is not our fault, as we have treated the subject fully in our columns. See SCIENTIFIC AMERICAN, vol. 56, page 177.—ED.]

DECISIONS RELATING TO PATENTS.

U. S. Circuit Court.—Eastern District of Wisconsin.

THE BUTZ THERMO-ELECTRIC REGULATOR COMPANY *vs.* THE JACOBS ELECTRIC COMPANY.

Jenkins, J.:

Letters patent No. 222,234, granted December 2, 1879, to Julien M. Bradford, for an improvement in electric heat and vapor governors for spinning and weaving looms, sustained, and held infringed by a second circuit breaker operating on the same principle and performing the same functions by analogous means or equivalent combinations, although the infringing machine may be an improvement on the patented invention and patentable as such.

The mere change in form or an alteration in unessential parts, or the use of known equivalent powers not varying essentially the machine or its mode of operation or organization, will not avail to avoid infringement.

It constitutes an infringement to manufacture for the purpose of use, even if not actually used.

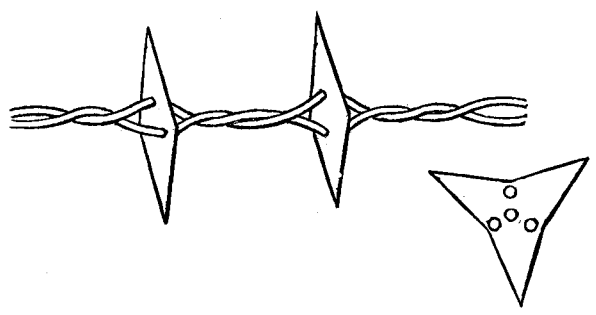
A New Ruling Pen.

An improved ruling pen, by Thomas Bennet, of Philadelphia, Pa., is made with one of its blades movable when under the finger. The pen may be set to make both light lines and heavy lines. If, in the progress of the work, heavy lines are needed, a pressure of the finger on the pen produces them. On releasing the finger, the pen returns to light lines.

THE BARBED WIRE PATENT.

It has long been known to the writer that a patent granted in France, to Louis Jannin, April 19, 1865, No. 67,867, is for a barbed wire fence, which antedates the earliest patents granted in this country for similar inventions. These United States patents were issued: to Hunt, July 23, 1867, No. 67,117; Kelly, February 11, 1868, No. 74,379; and Glidden, November 24, 1874, No. 157,124. The Washburn & Moen Manufacturing Company is the owner of these patents, and, as is well known, has repeatedly won numerous suits in the courts against infringers. A prominent decision was rendered in December, 1880, by Judges Drummond and Blodgett in the United States circuit court for the northern district of Illinois. It was here held that while natural thorns, broken glass, etc., had been used on fences to resist encroachments of animals, no one before Hunt's invention had made a "wire provided with burrs, spurs, or pricks," and that a fence made of such wires was first proposed by Hunt.

In the SCIENTIFIC AMERICAN for January 14, 1888, you call attention to a circuit court decision declaring the patent of Glidden invalid, because as early as 1859 a barbed wire fence had been publicly used. It appears that it required testimony covering some 10,000 pages of type-written matter to establish the defendants' position that the Glidden patent should be declared invalid for want of novelty. I will demonstrate by a few lines of description and a sketch that as early as June, 1865, a barbed wire fence was patented in France in the sense in which such term is understood in this country. Louis Jannin, of Fontenay-aux-Roses (near Paris), deposited a specification and drawing at the French patent office on April 19, 1865, and on June 24, 1865, the patent was delivered, and the papers were open to public inspection. From these papers, seen by me while in Paris, it appears that Jannin proposed to "string barbs on wire and then twist the same in the manner of a cord until the barbs remain fixed in place by the effects of torsion, but in cases where only one wire is pressed through the center of the barb it is fixed by solder." It is stated that the barbed wires are fastened to galvanized iron posts having earthenware bases. The subjoined sketch is



taken from the drawing of the patent, and shows sheet metal barbs.

I contend, in view of Jannin's patent, that the leading barbed wire fence patents, under which such enormous royalties were collected, never had a legal status in this country. In support of such opinion I cite the Supreme Court decision in the case of Gaylor *vs.* Wilder, 10 Howard, page 477, in which it was held that "a foreign patent for the same thing or a description of the thing in a foreign publication is as effectual to avoid the patent as if the patentee had seen the prior invention. Notice to him is not important."

By bringing the French patent of Jannin for the first time before the American public in your journal, I think I have shown that its disclosure years ago would have been of great benefit and made the broad idea of a barbed wire fence public property.

A. M. TANNER.

Coal.

"It may seem a 'reductio ad absurdum,'" said Professor J. S. Newberry, of Columbia College, in a recent lecture, "to attribute such mighty powers to a substance so common, so sooty, and in some ways repulsive, but a little thought will show us that it is scarcely more interesting in its practical value than in its history. Few of you have realized the magnitude and dignity of the work it is doing in the world, and fewer still have thought that it is really the sunshine of bygone ages, and that it has once composed the tissues of various strange plants, some of which are among the most graceful and beautiful of vegetable forms. Buried in the earth or covered with water, vegetable fiber decays or oxidizes slowly, forming in successive stages of decomposition peat, lignite, coal, anthracite, graphite, the hydrocarbon gases, and petroleum. By regulating and controlling the further oxidation of these we are able to utilize the resulting force as light or heat or motive power.

"To help you to realize the potency of this wonderful substance, coal, let me recall to your memories the measurements of the power evolved in its combustion. It is estimated that with the average engines now in use, about 1,500,000 foot pounds are practically evolved from the combustion of a pound of coal, and are available in the performance of any work done. Now, this is about the power exerted in a day's labor of an average man. Hence a ton of coal is capable of yielding an amount of force equivalent to that of six and two-thirds men, or of six men and a well-grown boy throughout the year. Or, the annual production of coal in this country and Great Britain is equivalent to a thousand million men working for a year."

Jugglers' Tricks—Practice as Well as Original Aptitude Required.

"I started operations when I was but six years old, playing with the eggs my mother intended for her puddings," said a juggler to a San Francisco *Examiner* reporter. "These I would throw in the air, catching them on a plate, always with the same result—a smash. This was really my first start. I always juggle with common things, for the simple reason that people go home and try to do it themselves. They will then find out how very difficult an apparently easy trick is. You must commence with small brass balls, making a start with a single ball in the left hand. Every throw leads you to feel the ball better. It is obvious why the start is made with the left hand. It is the more uncertain of the two, and training alone will make it as sure and safe as the right. Now, I will give you a rule for throwing knives in the air. If I have half a dozen, I propel one with just sufficient force to give it half a turn, another gets a whole turn, a third gets a turn and a half, a fourth two turns. I catch them all by the handle.

"One of the best of my many juggling feats is the egg and cannon ball. I catch first one and then the other on a plate. I learned by experience just to time the arrival of the egg on the surface of the plate, and I gather it up gently while it is falling. So it really slips on of its own accord. It is just the same with the cannon ball, though it weighs 33 pounds.

"Paul Cinquevalli is doing a very pretty trick now with a cigar and holder. After a little preliminary in the way of throwing them about, the holder suddenly drops into his mouth, the cigar finding its way into the holder shortly afterward. Then with a jerk of the head the cigar performs a double somersault, and again falls into its place in the holder. But Paul Cinquevalli told me that the most difficult trick he ever performed took him nearly two years before it was in a fit state to be introduced. It was suggested to him one night at supper. The guests insisted upon his giving them something new. So he took up his knife and fork and selected an exceptionally hard potato. He kept the three spinning in the air for some time, then suddenly cutting the potato in two, and keeping all going again until, as a finale, he caught one-half on the knife and the other on the fork. It was, as he said, an exceptionally lucky performance, for he had never attempted it before.

"I should like to tell you of a remarkable conjuring trick I saw performed while on a voyage from London to Calcutta. The conjurer was a Parsee, whom you might have taken for a respectable servant out of a place, but who was actually a small land owner who was traveling for pleasure, and had taken up conjuring as an amusement. Spreading a white cloth on the deck of the steamer, he sat down with his back resting against the companion hatch. As soon as he had settled himself, he turned to one of our fellow voyagers and asked for the loan of a rupee, which he requested should be given to one of the ladies present. The lady took it, and at the request of the conjurer looked at it and declared it to be really a rupee. The conjurer then told the lady to hand it back to the gentleman from whom he had borrowed it. The gentleman took it, and then followed the following dialogue:

"Conjurer: 'Are you sure that is a rupee?'

"Fellow Voyager: 'Yes.'

"Conjurer: 'Close your hand upon it and hold it tight. Now think of some country in Europe, but do not tell me your thought.'

"'Now open your hand,' said the juggler. 'See what you have got, and tell me if it is a coin of the country you thought of.'

"It was a f.5 piece, and our friend had thought of France. He was going to hand the coin to the Parsee, but the latter said: 'No; pass it to another sahib.' As I happened to be the nearest, the f.5 piece was handed to me. I looked closely at it, then shutting my hand, thought of America. When I opened it, I found a Mexican dollar. This I handed to the gentleman on my right, who in turn thought of Russia, and on opening his hand found a Russian silver piece in place of the Mexican dollar. The juggler performed several other tricks during the voyage, but they were of a commonplace kind, and in no way comparable to the coin trick, which I have never seen rivaled."

Why Rails in Use Rust Less Quickly than Rails at Rest.

The preservation of rails in use is not the result of vibratory motion, or of an electric action due to the passage of the trains, but to the formation of magnetic oxide, produced by the compression of the rust on the metal. The rails are thus protected against the action of moist air in the same manner as is iron oxidized by fire.—*W. Spring, Bull. de la Soc. Chim. de Paris.*

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One Hundred Thousand Butterflies.

None but those who have seen a hundred thousand butterflies, each differing from the other in some particular, can have the faintest conception of the wonderful beauty of many of these most delicate creations of nature. Nothing in art can approach them in delicacy of color, or equal their exquisite coloring.

Almost the finest collection of butterflies in the world is owned and has been made by Berthold Neumoegen, of the New York Stock Exchange. Only two collections in the world can compare with it. One of these belongs to the British Museum, the other to a public institution in Paris.

Mr. Neumoegen has spent twenty years and $35,000 in making this collection. It has been enriched by the efforts of some member of nearly every exploring expedition that has been organized during the last fifteen years. Specimens have been contributed by Livingstone, Stanley, Schwatka, and members of the Greely relief expedition. Gorgeously hued victims from the Victoria Nyanza to Lady Franklin's Bay, from Borneo to Labrador, from Cape Colony to Kamtchatka, and, in fact, from every country between "Greenland's icy mountains and Afric's coral strand," are crowded into this army of 100,000 strong.

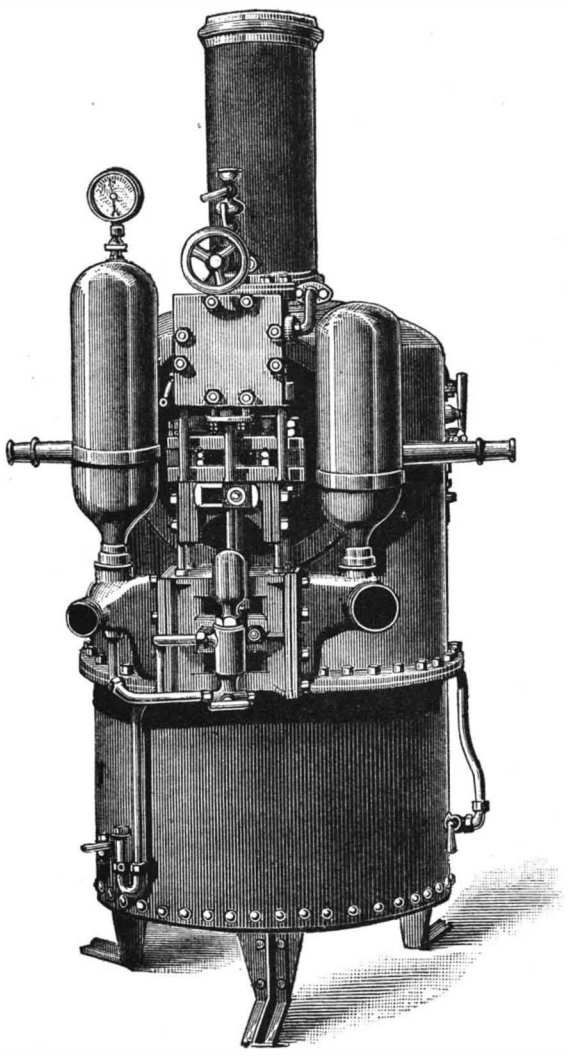
To every specimen is attached a card, giving its name, sex, family, and the name of its discoverer. Several new butterflies have been named after this enthusiastic collector.—*Agassiz Companion.*

How True It Is.

You can get all the opinion you want on both sides of a question nowadays. Oatmeal had not long ago been reported to be a healthful food, when some physician arose to deny it and to assert that it produced dyspepsia. Allowance is always to be made in such a question for the variations of human stomachs and constitutions, so that what may be a good food for one person may not be for another. The truth about oatmeal for the generality of persons (and they are the only persons you can speak for) is that, if it is eaten in only a partially cooked condition, it is not healthful; and neither is flour, corn meal, and many other articles of food. Indigestion and acidity of stomach are caused for some people by the eating of sugar or other sweets on oatmeal, and they get the same effect if they eat these sweets on rice or bread. Cream, too, may be too much fat for a sensitive stomach if put on oatmeal. In these cases it is not the oatmeal, but either its insufficient preparation or the addition of an improper food that causes the stomach trouble. If a person will eat a moderate amount of oatmeal, cooked and prepared as his needs may demand, there can be no question that it is healthful, digestible, and highly nutritious.—*Good Housekeeping.*

A HAND CART STEAM FIRE ENGINE.

The little machine we illustrate has been brought out by the Sphincter Grip Hose Company, of London, and is described in the *Engineer*. It consists of a little



HAND CART FIRE ENGINE.

steam pump of the drag-link type, mounted on a vertical cross-tube boiler of the standard description. All the parts usually made of gun metal or brass in the best practice are here of gun metal or brass. The entire machine in all its details is exceedingly well got up. This we can assert as the result of personal inspection; nothing has been left undone to make this little machine efficient and trustworthy.

It is conveyed to a fire on an ingenious hand carriage with high wheels. It is carried between the wheels, as shown, by trunnions. When it has arrived at a fire the carriage is removed by taking out two pins, which permits the trunnions to slip out of their bearings in the carriage, which is then wheeled away, and the engine then stands on three supports, as shown in the detached view. It is then used like any other fire engine, and will throw a powerful ¾ in. jet. The boiler pressure is 100 lb. on the square inch, and steam can be got up in seven minutes from cold water.

It might be supposed that the engine would be unsteady when put down to stand on three legs, so to speak, in the street; but we are assured that this is not the case, and that no trouble is experienced from this cause. The engine will do much more work than a manual driven by thirty men, and at much less cost. It appears to us to meet a want in a very satisfactory manner.

Electric Prostration.

New conditions develop new diseases.

The "railway spine" has taken its place in medical nomenclature, and the "caisson disease" has also been recognized. Now a third has been added to the list, in a condition which has received the name of "electric prostration."

This is a disorder, says the *Medical Era,* of Chicago, that affects those who work under strong electric lights. After an exposure of one or two hours the workers have a painful sensation in the throat, face, and temples, the skin becomes of a coppery-red color, there is irritation of the eyes, with profuse lachrymation, lasting forty-eight hours. After five days there is desquamation of the discolored skin.

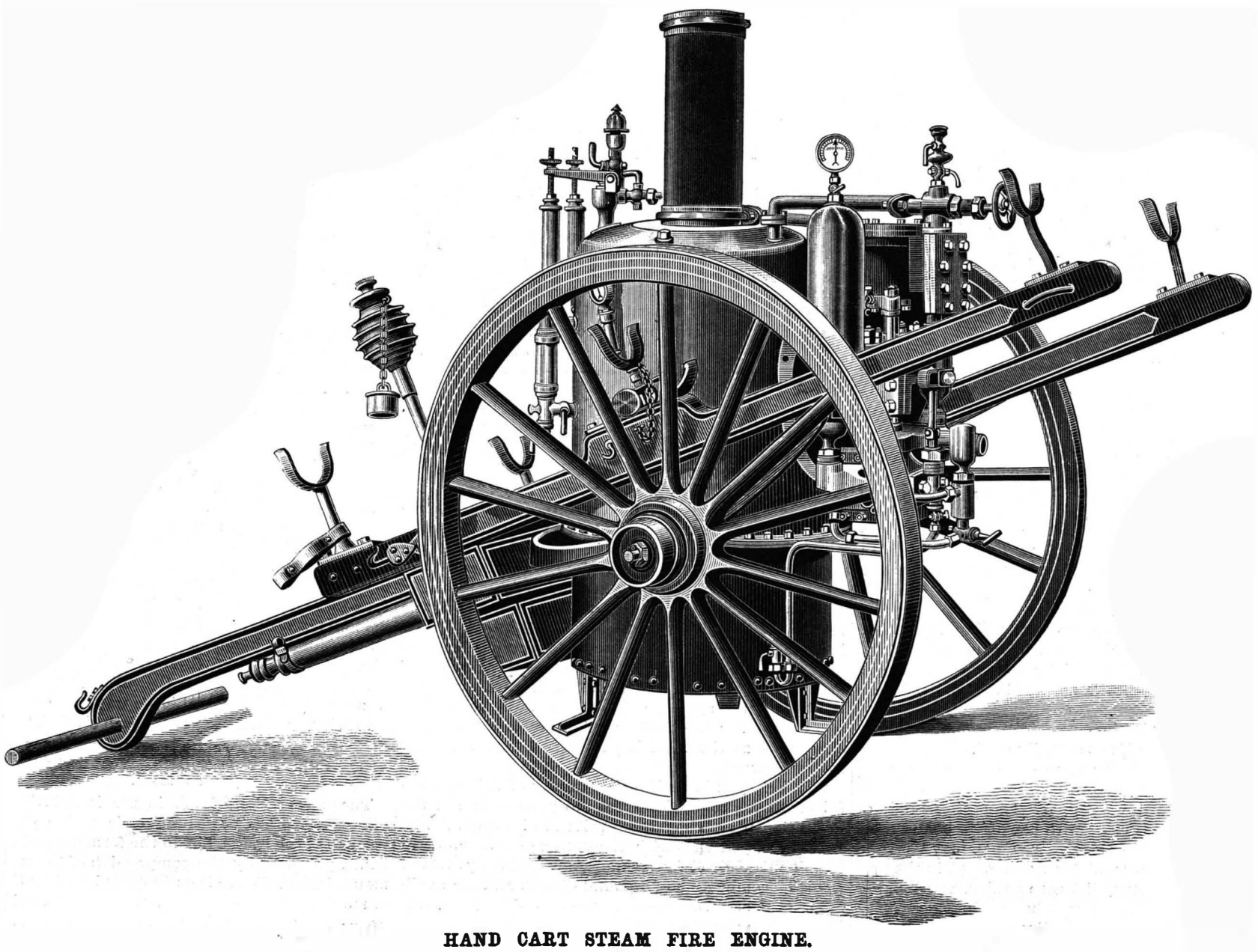
These symptoms do not follow exposure to the ordinary Edison light, but to one of excessive strength, such as is used in electric furnaces for the quick heating of metals. Some mitigation of the symptoms may be procured by the use of dark colored glasses, but not entire immunity. The effects seem to follow exposure, not to the heat, which is not great, but to the intensely brilliant light.

Thus has a new industry created a new disease, for which the profession will be called upon to find a remedy.

Curiosities of the Phonograph.

Subscribers to whom are rented machines can have left at their door every morning the waxy tablets known as phonograms, which can be wrapped about a cylinder and used in the phonograph.

On these tablets will be impressed from the clear voice of a good talker a condensation of the best news of the day, which the subscribers can have talked back at them as they sit at their breakfast tables.



HAND CART STEAM FIRE ENGINE.

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SIMPLE EXPERIMENTS IN PHYSICS.

BY GEO. M. HOPKINS.

Impulses which, occurring singly or at irregular intervals, are incapable of producing any noticeable effects, may, when made regularly, under favorable circumstances, yield astonishing results. The rattling of church windows by air waves generated by a particular pipe of the organ, a bridge strained or broken by the regular tramp of soldiers or by the trotting of horses, the vibration of a six or eight story building by a wagon rumbling over the pavement, a factory vibrated to a dangerous degree by machinery contained within its walls, a mill shaken from foundation to roof by air waves generated by water falling over a dam, are all familiar examples of the power of regular or harmonic vibrations.

Harmonic vibrations result from regularly recurring impulses, which may be very slight indeed, but when the effects of the impulses are added one to another, the accumulation of power is sometimes very great.

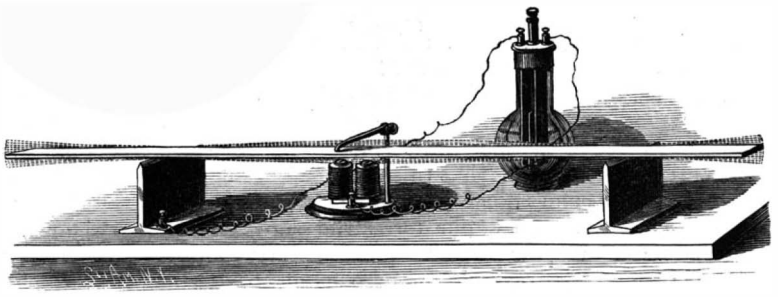
To secure cumulative effects, the impulses must not only be regular in their occurrence, but the body receiving the impulses must be able to respond, its vibratory period must correspond with the period of the impulses And further than this, the impulses must bear a certain relation to a particular phase of the vibration, in order that they may act upon the vibrating body in such a way as to augment its motion rather than diminish it.

There are railroad bridges that vibrate alarmingly when crossed by locomotives running at a certain speed, the vibrations being caused by the comparatively slight lack of balance in the driving wheels and connecting rods. For this reason the speed is restricted on such bridges.

During the early tests of the East River bridge between New York and Brooklyn it was found that the structure was so massive and its vibratory period so slow that it could not be injuriously affected by the marching of men or the trotting of horses; consequently, travel proceeds on this bridge as upon any highway.

A well known English physicist is reported to have said that with suitable appliances he could break an iron girder by pelting it with pith balls. An experiment of this kind would certainly show in a striking manner the effects of very slight rhythmic impulses. As it is manifestly impracticable to perform such an experiment, an easier method of illustrating harmonic vibrations must be sought.

In the accompanying engravings, Fig. 1 shows how a bar of steel may be set in active vibration by drops of water. The bar is supported at nodal points upon angular pieces of wood. Above the center of the bar is arranged a faucet, which communicates with the water supply. The bar is first vibrated by hand, and the faucet is adjusted so that the water drops in unison with the vibrations of the bar. The motion of the bar is then stopped, and the water is allowed to drop on it. The bar soon begins to vibrate, and in a short time the vibration acquires considerable amplitude. In Fig. 2 is shown an experiment in which the intermittent pull of an electro-magnet is made to accomplish the same thing. In this case the steel bar forms a part of the circuit. The magnet is provided with a light wooden spring-pressed arm, carrying a contact point and a conductor. This arm is arranged to follow the bar up and down through the upper half of its excursion, breaking the contact at the median position of the bar. The magnet becomes alternately magnetized and demagnetized, and the bar is alternately pulled down and released. The bar used in these experiments is ¼ in. thick, 1¼ in. wide, and 8 ft. long. A much larger bar might be used. Without doubt, even an iron girder of great size and weight might be set in active vibration by the same means.



Fi . 2.—VIBRATION BY MAGNETIC IMPULSE.

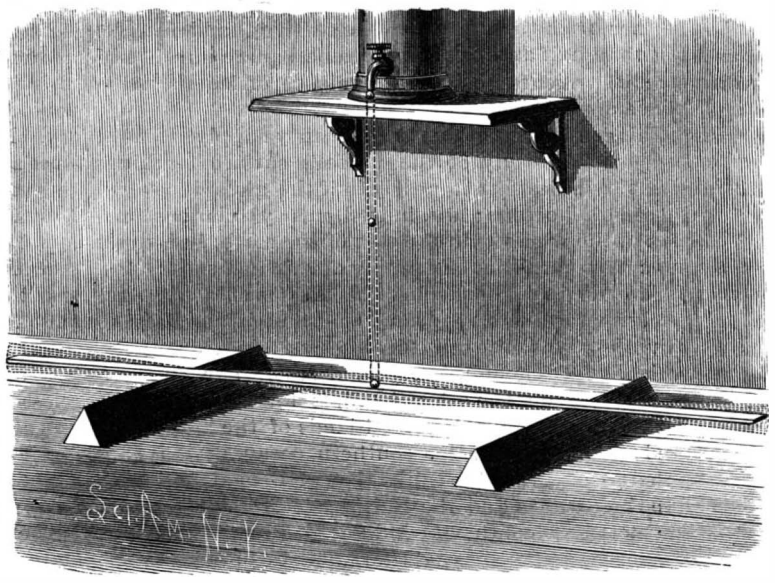


Fig. 1.—HARMONIC VIBRATION.

THE NEW DIEULAFOY HALLS AT THE LOUVRE.

Our readers will remember that we several months ago published an account of the travels of Madam Jane Dieulafoy, the young and intrepid explorer, who shared with her husband the fatigue and perils of the interesting excavations made in Susiana by the expedition of which he had command.

Mr. and Mrs. Dieulafoy have deposited the curious collection brought back by them in that part of the Louvre that had been put at their disposal. An inauguration of the halls that will henceforth bear the name of their organizers took place quite recently. The objects exhibited therein were discovered at 1,300 feet from the Persian Gulf, in a country in which no roads are laid out, and in which means of communication are consequently wanting. The whole had to be transported on camel back to a distance of 240 miles. From this may be seen how difficult was the undertaking, and what energy had to be displayed for several consecutive years, in order to make it a success.

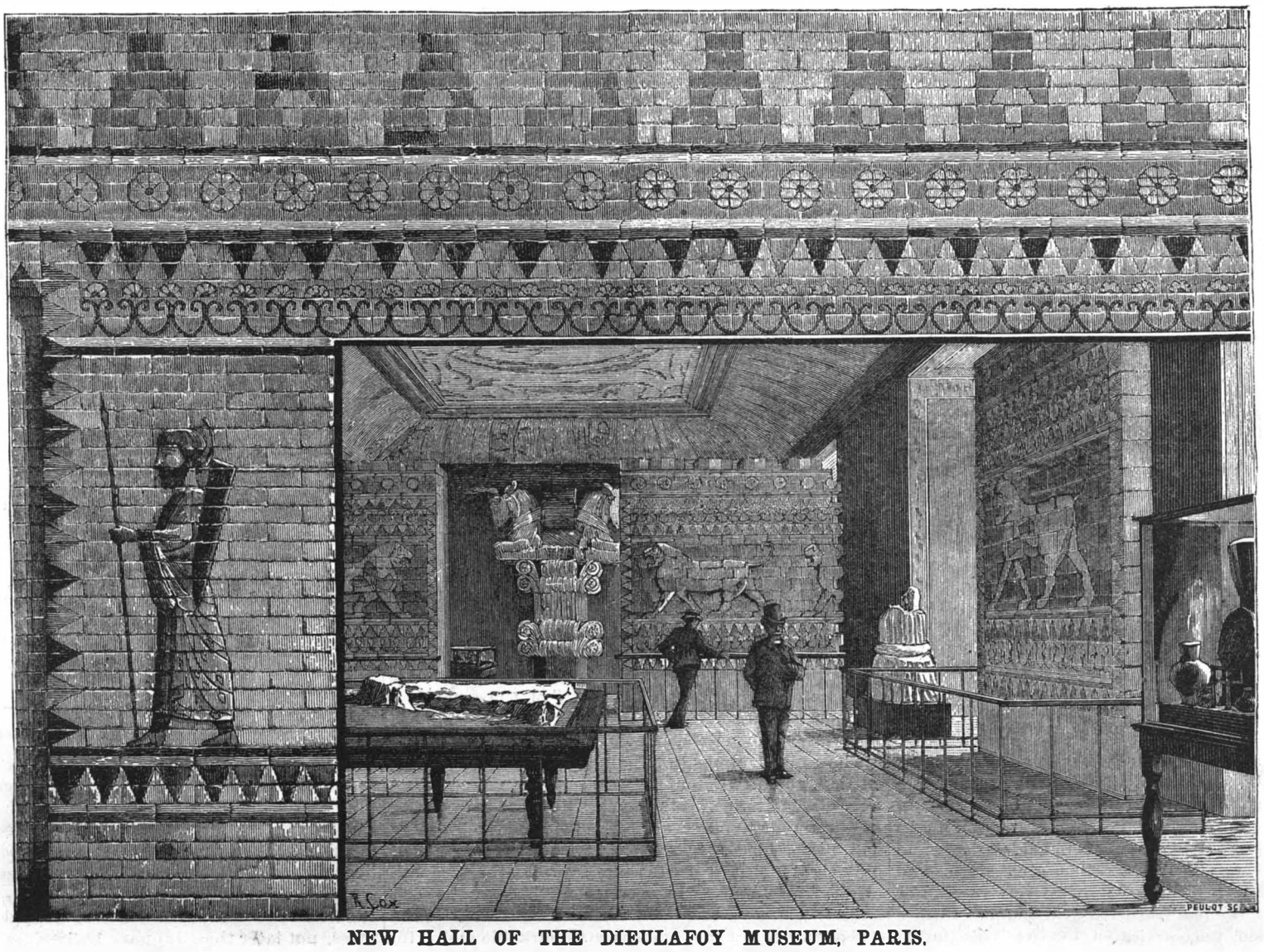
As may be seen from an examination of our engraving, the Dieulafoy halls contain some exceedingly curious objects. Among other things, there are fragments of walls, and even entire walls from the palace of Darius, and glazed bricks set off with ornaments of wonderful coloring. On one side we see lions, and on the other archers in profile holding their weapons in hand.

The sides of the two halls are hidden by these walls, the aspect of which is very pleasing and harmonious. Their facing is of a turquois blue color, and the black-visaged figures are clad in yellow and white, with the skirt escutcheoned with the three towers of Susa. In the rear of the museum we remark a colossal capital formed of oxen's heads.

The decoration of the halls in which are grouped so many interesting souvenirs of a vanished civilization is in the Persian style, and the ornamentation has been very conscientiously elaborated.

Clothed in the male costume that she usually wears, and a buttonhole decorated with the ribbon of the Legion of Honor, Madam Dieulafoy did the honors of the halls to the few privileged invitees who were present at the inauguration.—*Le Monde Illustre.*

NEXT to moral weakness, a fear of the difficulties to to be met is, undoubtedly, the most unfortunate mental trait of any young person.



NEW HALL OF THE DIEULAFOY MUSEUM, PARIS.

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[FROM THE POPULAR SCIENCE NEWS.]

Our Neighbor Across the Way.

BY PROF. C. A. YOUNG.

The planet Mars occupies in the solar system the orbit next outside the earth's, and at times comes nearer to us than any other heavenly body, excepting only the moon and the planet Venus, or now and then a stray comet. But when Venus is nearest the earth, her illuminated surface is turned away; so that the moon alone offers better opportunities for telescopic examination than does Mars when, at its opposition, it is for a season the chief ornament of the evening sky.

The reader must not, however, imagine that, because the planet is then nearer than other heavenly bodies, its distance is really comparable with any geographical distances on the earth's surface. Even under the most favorable circumstances, the distance is never less than about 36,000,000 miles, which is about one hundred and fifty times that of the moon, and a century's railway journey for a "celestial limited," running 40 miles an hour, without stops. Even with a magnifying power of a thousand, which is about the highest that can be advantageously used on any but the very largest telescopes, and under exceptional circumstances, the planet is still optically fully 36,000 miles away, and shows in the field of view a disk about 6½° in diameter, upon which the smallest objects visible would need to be 25 or 30 miles across. A rather powerful field glass, with a magnifying power of six or seven, would bring the moon as near.

It is only about once in fifteen years that Mars comes as near as even 36,000,000 miles. Its orbit is so eccentric, that the interval between it and the orbit of the earth varies all the way from 36,000,000 miles to 61,000,000; and it is only now and then that, as the two planets circle round in their respective tracks, the passing point is where the tracks come nearest. The last instance of a very close approach was in 1877; the next will be in 1892.

Mars is much smaller that the earth, its diameter being only about 4,200 miles. Its bulk therefore is only about one-seventh, and its surface about three-tenths of the earth's.

By means of the motion of its swift little moons, it is easy to ascertain that its "mass" (*i. e.*, the quantity of matter it contains) is somewhat less than one-ninth of the earth's, and consequently its density is only three-fourths, and its superficial gravity just about three-eighths, of the earth's; *i. e.*, a body which at the earth's surface weighs 100 pounds, would weigh only 38 pounds there, and a force which here would project a body to an elevation of 100 feet would throw it there to a height of 265. This is a point of considerable importance in considering the physical conditions of the planet.

When examined by the telescope under favorable conditions, Mars is a very pretty and interesting object. It shows a ruddy disk, which, for some not certainly known reason, is much brighter at the edge than near the center; in this respect resembling Mercury, Venus, and the moon, but standing in marked contrast with Jupiter and Saturn. According to Zollner, the "albedo," or reflecting power, of its surface is about 26 per cent; that is to say, it reflects about 26 per cent of all the light which falls upon it—about as much as ordinary sand. This is considerably higher than the albedo of either Mercury or the moon, but only about half that of Venus or any of the major planets.

Just at the time of opposition the disk is of course perfectly circular; but at other times it is more or less "gibbous," like the moon a day or two from the full. It varies greatly in apparent size, according to the changing distance of the planet, which ranges all the way from 250,000,000 miles to 36,000,000.

The disk is mottled with spots and streaks, which are not arranged in belts with an evident relation to the planet's equator, as in the case of Jupiter and Saturn, but are distributed irregularly over the surface. A telescope of not more than seven or eight inches aperture shows them fairly well, and the more conspicuous of them can be seen with much smaller instruments. As we watch them, they drift across the disk from east to west, and many of them are so permanent and well defined, that by their help we can ascertain the length of the planet's day with very great accuracy. The latest and probably most precise determination is that of Bakhuyzen, who gives the time of rotation as 24 h. 37 m. 22·66 s. The only question is as to the odd hundredths of a second.

Most of the spots and markings are permanent, but not all. Bright patches are now and then observed which seem to be evanescent, like sheets of cloud that for a time conceal the oceans and continents beneath, and then rapidly clear away.

Such phenomena, of course, imply an atmosphere more or less like our own, and Dr. Huggins has confirmed the fact by a direct observation of the lines of water vapor in the planet's spectrum. But many things go to show that this atmosphere is much less dense and extensive than the earth's. On Mars great storms and widespread cloud veils are comparatively rare. For the most part the real features of the planet's surface are clearly seen, uncomplicated by overlying mists, while the surface of the earth at any given moment would probably be fully half obscured, as seen from the moon or Mars.

The planet's equator is inclined to its orbit at an angle of nearly 28°, and, as a consequence, Mars ought to have seasons much like those of the earth. One very beautiful phenomenon seems to show that this is actually the case. In the neighborhood of the planet's poles there are brilliant spots, evidently composed of some substance which reflects light very abundantly; and it is natural to think of ice or snow, because, as Sir W. Herschel observed a century ago, each spot grows larger when it is turned away from the sun, and dwindles in the summer, just as a polar ice cap would. It is worth noting that this snow cap, if such it really is, never comes down to middle latitudes, as does the wintry envelope of our terrestrial snow. In January "the man in the moon" would see pretty much all that portion of the earth's northern hemisphere which lies above 45° of latitude as one gleaming white expanse, unbroken except where the Atlantic and Pacific Oceans interrupt its continuity. Although Mars is so much further from the sun than the earth is, and receives less than half as much heat to each square mile of surface, it presents no such prevalence of ice in either hemisphere.

This can hardly be due to the scanty supply of water, because the study of the planet's surface markings seems to indicate that nearly half the globe is covered by seas and oceans; not, indeed, nearly so large a fraction of the whole as in the case of the earth, but quite enough to furnish a fair supply of rain and snow.

The northern hemisphere of Mars is of a comparatively uniform orange-colored tint, and is supposed to be mainly land, though it incloses certain dark spots, which, likely enough, are inland seas. The southern hemisphere, on the other hand, is for the most part darker, with here and there islands of the lighter colored surface. From this southern ocean, as it is supposed to be, great bays, like that of Bengal, and arms like the Red Sea and the Baltic, penetrate deeply into the northern continent; indeed, as Proctor long ago remarked, a very striking characteristic of Mars is the manner in which land and water are divided and intermeshed, there being on the planet no unbroken mass of land to correspond to the Asiatic continent, nor any ocean like the Pacific.

The principal features of the planet's geography (strictly areography) are now quite beyond question, and have been several times fairly mapped. Thus far, however, no satisfactory nomenclature has been settled. Upon Mr. Proctor's map the names assigned are mostly those of astronomers who have made contributions to our knowledge of the planet's topography. Thus we have the continents of Herschel, Dawes, Maedler, and Secchi, the oceans of Dawes and De la Rue, and the seas of Kaiser, Beer, and Delambre. Schiaparelli, on the other hand, with better taste, derives his names from ancient geography and legend. We have for the land masses, in the order before mentioned, Libya, Acria, Arabia, and Chryse. Syrtis Major replaces the Kaiser Sea (which is, on the whole, the most conspicuous object on the planet), and De la Rue Ocean becomes the Mare Erythræum. But while the principal features of the planet's configuration are thus fairly well made out, especially those near its equator, there is no such agreement in minor details, and the different maps are widely at variance. Schiaparelli, of Milan, who has had the great advantage of the Italian atmosphere, has introduced into his charts a great number of delicate objects, which have never been satisfactorily seen by others, though many partial confirmations have been obtained. In place of the comparatively ill-defined and hazy streaks seen here and there by other observers, he represents the northern hemisphere of the planet as covered by a network of fine, hair-like lines, which he calls "canals," and supposes to be waterways. Some of these extend over 90° of the planet's circumference, or nearly 3,000 miles in length, with a width not to exceed 30 or 40 miles.

In Schiaparelli's map of 1877, which is the one usually copied in the text books, only a few of the canals appear, but on his more recent charts there are nearly sixty of them.

The most remarkable thing about them remains to be stated: In 1881 he found most of them to be *doubled;* the single lines which intersect the continental masses had almost without exception become *pairs* of parallels, like the two tracks of a railroad, with a very uniform distance of 150 or 200 miles between them. We say "had become," because it is his opinion that this "gemination" of the canals is a temporary phenomenon, depending somehow on the progress of the martial seasons.

These observations have naturally excited much discussion, and at present scientific opinion is considerably divided in regard to them. No other astronomer has been able to observe the canals in any such extent and perfection as Schiaparelli with his telescope of only eight inches aperture; but several others, especially Perrotin at Nice, have seen something of the sort, and furnish a partial confirmation of his work. The "gemination" of the canals is so remarkable and so inexplicable, that many are disposed to think the phenomenon a purely optical one, due to some astigmatism and imperfect focus of either the instrument or of the observer's eye; or else (as Mr. Proctor suggested rather vaguely) an effect of diffraction in some way. If it were not for the observations of Perrotin, I for one should accept the theory of astigmatism, for I have myself often seen delicate single lines in the solar spectrum appear double from some slight pinch of one of the lenses in the spectroscope. But it is very difficult to see just how two different observers, with two such different instruments as the twenty-nine inch telescope at Nice and the little eight inch at Milan, could see the phenomenon alike if it were merely optical. There is some mystery about the matter, and it is clear that we must wait for further and more conclusive evidence before building any considerable structure of theory upon the reported facts. The only suggestion so far made which seems worthy of mention here is that the "canals" may be watercourses of some sort, at times flooded, and at other times drained off, so as to become invisible.

During the last opposition (in April) the planet's nearest approach to the earth was about 56,000,000 miles, and it was so far south in the sky that it could not be very well observed in Europe or this country. But both at Milan and Nice some of the canals were seen, and seen as double for a time. Perrotin also reported that a continental tract which he had named Libya (a part of Proctor's "Herschel Continent") *had mostly disappeared, as if inundated.* While this observation of his is partially confirmed by some observers, it has been positively disputed by others. With the Lick telescope, Libya was seen last spring by Professor Holden on several occasions; in fact, whenever it was favorably placed for observation at the time the telescope happened to be directed on the planet. Nor was anything seen at Mount Hamilton like the "gemination" of any of the canals, though in some instances a widish streak was observed, in place of the sharp and narrow line delineated on the map.

The two little satellites (discovered by Professor Hall at Washington in 1877) were, of course, seen and easily observed.

It is to be hoped and expected that the great telescope on Mount Hamilton, with its advantages of situation and its freedom from the atmospheric embarrassments which so seriously interfere with the work of our other large instruments, will in 1890 and 1892 be able to solve definitely the interesting problems that our neighbor proposes for our investigation.

Princeton, Nov. 9, 1888.

A Forty-five Foot Bed of Salt.

Extensive explorations, continued through several years, and extending over a wide region in the upper part of the Onondaga Valley, about seventeen miles southward from the city of Syracuse, have been rewarded with complete success. Under the direction of William B. Coggswell, general manager of the Solvay Process Works, wells have been sunk in five different localities—one on the hill side at Jamesville, another at Cedarville, one near Onondaga Valley (village), one in the south part of the town of Lafayette, and now another in that town, also up the valley near Cardiff.

On the fourth trial full success was attained. The fifth, now in progress, promises a like result. In other instances salt water was found. The successful boring was at a point seventeen miles south of this city, on the easterly side of the valley at the foot of the hills. It was carried to a sufficient depth, and a solid bed of rock salt forty-five feet in depth was discovered. The boring was in the shales through 735 feet of the deposit, then through 500 feet of limestone, when, underneath and next to it, at a depth of 1,210 feet from the surface, a solid body of rock salt forty-five feet thick was reached. The boring was carried through the deposit. Operations were begun early in the season, but some obstacles were encountered, making necessary a change of location, when the work was prosecuted to this successful termination. The well now in progress is thirteen miles south of the city, four miles nearer than the place at which the "great find" was made, and there is every prospect of equally good results there, without the necessity of boring more than 1,000 feet. The process is expensive and laborious, and the Solvay Process Company has expended thereon not less than $35,000, for which the success attained will give full recompense.—*Syracuse (N. Y.) Journal.*

Meteorological Apparatus and Photographs.

The New England Meteorological Society proposes to have a loan exhibition of meteorological apparatus, photographs, etc., at the Institute of Technology, Boston, in connection with its fourteenth regular meeting in January, 1889. For this purpose the society invites contributions of articles to be sent to A. Lawrence Rotch, Physical Department, Massachusetts Institute of Technology, Boston, by prepaid mail or express, not later than January 12, 1889.

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RECENTLY PATENTED INVENTIONS.

Engineering.

CAR COUPLING.—Daniel B. Davis and Josiah J. Fisher, Laramie, Wyoming Ter. This invention provides a means of coupling cars without passing between them, also for elevating the drawhead or adjusting it laterally, and for sustaining the coupling pin in an elevated position when the cars are uncoupled.

AUTOMATIC CAR BRAKE.—Willard R. Wood, Jr., Hedgesville, N. Y. A gear wheel is secured to one of the axles, with which a segmental gear wheel is adapted for engagement, yielding bearings carrying the segmental gear wheel, and a double wedge engaging the yielding bearings, and operated from the brake staffs so as to move the segmental gear wheel into and out of mesh with the wheel on the axle.

RAILWAY SWITCH.—Henry Lesly, Birmingham, Ala. The switch frame is pivoted and consists of pointed rails and suitable cross pieces, with an arm having slots and a projection in combination with a connecting rod, whereby either switch frame may be operated independently of the other by the same lever, or both switch frames may be operated simultaneously in opposite directions.

HYDROCARBON MOTOR.—Oscar Brunler, New York City, and Emil Capitaine, Berlin, Germany. This invention relates to motors worked by a mixture of air and finely divided oil, petroleum, or naphtha, an appliance being arranged within the piston for dividing or sprinkling the oil or naphtha, while the air is caused to pass with great velocity through the appliance into the cylinder, in the direction of the cylinder cover.

GAS COMPRESSING PUMP.—Thomas Farnsworth, San Antoino, Texas. This is a compressor pump for use in connection with refrigerating machines, all parts being open to the action of water or other cooling medium, preventing the gas from becoming superheated and producing more pressure than is required, while the construction is simplified.

WELL SINKING MACHINE.—William B. and Joseph R. Coffin, Bliss, Neb. This invention covers a novel construction and arrangement of parts, the tube to be used in drilling the well to be operated by hydraulic pressure, while the tube itself is made to form a permanent part of the well after water is reached.

ROCK DRILLING TOOL.—James W. Wyckoff, Marquette, Mich. The drill has a cutting head with an operating face formed with acute angular opposite ends and side cutting edges, whereby, when reciprocated, the drill holes will be made long in proportion to their width, and the rock will be split off in merchantable blocks or slabs, requiring less labor in finishing or dressing the quarried stone.

AIR COMPRESSOR.—Emil Kaselowsky, Berlin, Germany. This compressor combines with a water jacket externally ribbed initial compression cylinders, open at their upper ends, and a final compression cylinder within the jacket, with other novel features designed to improve the construction of apparatus for pumping and compressing air.

Miscellaneous.

FOLDING BED.—Walter T. Green, Clinton, Mo. This is a bed of which the casing may be a dressing case or other article of furniture, the bed being of simple and economical construction, wherein the bedding will be contained within the bed when folded up, while the body of the bed is so light as to be readily manipulated with but little effort.

TELEGRAPHY.—Percy F. Jamieson, Batavia, Ohio. This invention provides a telegraph system in which the key used in sending messages will automatically close the circuit as soon as released by the operator, thereby avoiding the necessity of switches and the inconvenience arising from leaving the line open.

STOVE LID.—William A. Martel, South Orange, N. J. This lid is formed with a network disk and a ring having vertical pins which pass through holes in the disk and project above it, to constitute a support for a pan or kettle, being specially adapted for use over an oil flame, whereby the heat will radiate freely and the soot be prevented from escaping.

PUMP.—William Keast, Russell Gulch, Col. This invention relates to an improved valve-operating mechanism to be applied to the suction box of a pump formerly patented by the same inventor, whereby all springs are avoided, and the operating rods will not be distorted in operation.

BURGLAR ALARM.—Janko L. Mikich, Dallas, Texas. It is a door and window burglar alarm which can be conveniently carried from place to place and readily put in position for use, a cartridge being detonated by the tripping of the alarm, as a door or window is opened, when the alarm has been placed in position adjacent thereto, the invention being especially useful for travelers.

VEHICLE WHEEL.—Gunder Olsen, Houghton, Dakota Ter. The hub and connected parts of this wheel are so arranged that, by a slight movement of the hub and parts, a force is exerted on the spokes and felly to tighten or loosen the ties, the wheel being also so constructed as to exclude dust from the journal.

PRINTING TELEGRAPH.—George V. Sheffield, Schenectady, N. Y. The invention consists in a transmitter formed of two rollers to carry forward a perforated sheet, spring-actuated fingers and line wires corresponding to them, with other novel features, for sending messages telegraphically in the form of a printed strip or stencil, with an attachment for making an audible signal for each letter printed.

BOUQUET HOLDER.—John G. S. Smith, Rome, Ga. This invention consists of a small bottle supported on a shield, adapted to be secured to clothing or drapery by means of pins held in the shield, whereby the stems of the flowers are supplied with water and kept fresh a long time.

SNAP HOOK.—Charles E. McClintock, St. Joseph, Mo. This hook has a spring-actuated tongue prolonged beyond its pivot through the back of the hook, and provided with a thumb piece by means of which the tongue may be operated.

LAMP FILLER.—Marion W. Paxson, Virginia City, Nev. This is a filler which may be attached to an oil can and the valve opened, when, by pressing on the sides of the can, the oil may be started and caused to flow, being an improved device for drawing oil from a can by siphon action.

STAR FINDER.—Hubert R. Johnson, Natrona, Pa. An arm is mounted to turn on a suitably constructed tripod, the upper part of the arm supporting a clamping screw on which turns an upwardly extending arm carrying a screw with an arm supporting at its upper end a disk with degrees and subdivisions, the instrument being used in connection with a table in which the north polar distances and the right ascension of each star or other heavenly object are given.

FOUNTAIN RULING PEN.—Julius G. Zwicker, Austin, Minn. Combined with the two jaws and a tubular handle is a centrally arranged feed tube, with yoke-shaped piece and screw nut for adjusting the jaws, a swiveling thimble, and other novel features, avoiding the necessity of frequently refilling the pen, preserving the adjustment of the jaws, and being economical of ink.

DENTAL ANODYNE.—Robert I. Hunter, Norfolk, Va. This is a compound designed to be employed for allaying the sensitiveness of decayed teeth, and consists of cocaine, chloral, and other ingredients, used in proportions and after a manner described.

ROAD CART.—Lewis J. Lyman, Manhattan, Kansas. To the axle are secured the two side bars to the rear ends of which the ends of the rear spring are attached by flexible connections, which suspend the spring and permit it to swing in all directions, with other novel features, whereby the body is relieved of much jar and motion and rendered much easier riding than the common road carts.

CLOCK STRIKING MECHANISM.—Chaim Aronson, Brooklyn, N. Y. This is an improvement adaptable to clocks operated either by springs or weights, whereby the full hour is struck at every quarter hour, the mechanism for driving the minute and hour hands being of any approved construction.

NIGHT LIGHT ATTACHMENT.—James and William J. Stratton, Brooklyn, N. Y. This invention relates to an improvement on a formerly patented invention of the same inventors, improving the connection between the stand and the lamp socket, facilitating an adjustment to throw the light at different angles and upon different objects as desired.

LOCK HINGE.—Thomas Spriggs, Mitchell, Kansas. This is a door check for holding doors in different open positions, a socket piece being mounted on the door frame and a socket piece on the door, in combination with a vertically sliding bolt having locking projections adapted to engage the socket pieces, and a lever for operating the bolt.

SHOE FASTENING.—George T. Stevens, Auckland, New Zealand. The shoe is made with a stiffening at the top to sustain the strain of the laces, and provide means whereby the shoe may be conveniently and readily expanded at the top for the insertion of the foot, and will then be expeditiously laced by simply drawing upon the projecting extremities of the strings.

FUMIGATOR.—John S. Dillman and William B. Kyle, Moscow, Idaho Ter. This is a device for forcing poisonous fumes or gases into holes in the earth to destroy gophers, rabbits, or other burrowing animals, being an exterminator consisting of an air and smoke pump, and a fire box arranged for easy connection, so as to be readily operated with straw or wood and sulphur.

WASHING MACHINE.—Cyrus R. Crane, Housatonic, Mass. The machine consists of a series of tanks, each having a separate water supply and separate overflow, and with revolving rollers, being particularly designed for use in various bleaching operations wherein the fabrics are treated in continuous lengths.

TWO-WHEELED VEHICLE.—Emery W. Baxter, Burr Oak, Mich. The body of the vehicle is made with curved side bars, each formed of two curved plates, preferably of steel, bolted or riveted together, and between them, at the bottom of the body, are curved plates, preferably of cast iron, with bolts to which the slats are secured, a guard being attached to each plate to hold the yoke in place.

WAGON GEAR.—Robert Fernandez, Brooklyn, N. Y. An elliptical spring mounted on the head block supports the body in the usual manner, while this spring is relieved by a semi-elliptical spring arranged central to the wagon, the lower half of this semi-elliptical spring being secured to the upper fifth wheel by a clip, the invention covering also other novel features.

COCKEYE.—John H. Charters, Ekalaka, Montana Ter. The device is preferably made of a flat plate stamped with slot for attachment to the trace, and with two other connected apertures, one of which is of sufficient size to pass readily over the head of a headed bolt on the end of the singletree, the other aperture being of about the same diameter as the shank of the bolt.

HORSE COLLAR.—Alexander McKenzie, Auburn, Ontario, Canada. This collar has a rim, designed to be a practical substitute for hames, and to compel the pad to essentially retain its shape under all conditions until rendered worthless by constant use, while the construction is intended to be simple and economical.

WATER HEATING MANTEL.—Jacob Friedlander, Memphis, Tenn. The mantel, having a grate fireplace, is built with hollow portions and connecting pipes projecting beyond its face, other pipes built in the chimney breast connecting with the hollow portions, while air openings and a water inlet are provided, making a mantel which will effectually aid in heating the room without generating foul or dry air.

SELF-BINDERS, ETC.—Edwin B. Karn, Britton, Dakota Ter. This invention is in the nature of a roller tension device for self-binding harvesters, but which is also designed to be applicable for general use, the invention covering a peculiar construction and arrangement of devices operating under a rolling friction, whereby the tension is not likely to break the cord or twine if lumpy or weak in places.

PIANO ACTION.—Joseph C. Price, Baltimore, Md. This invention provides simple constructions for lifting the rear ends of the keys when the soft pedal is operated to correspond with the movement of the hammer rest, effected by such movement of the soft pedal, so as to preserve the elasticity of the keys and cause all parts to work in harmony.

BOX FRAME BENDING MACHINE.—Sylvester Valentine, Hagerstown, Md. It is specially designed for bending into shape previously prepared wood, and has a work bed with a fixed or stationary section and a series of folding sections actuated by a lever, to dispose the bed sections at right angles to each other, with an automatically retracting gauge, means for effecting individual movement of the sections, and other novel features.

ICE CUTTER.—Daniel Williamson, Sunbury, Pa. It is a hand cutting machine, slowly propelled by means of a crank, the same power also operating the cutting chisel, for cutting grooves upon the surface of the ice upon rivers, to facilitate its division into regular blocks preparatory to harvesting.

SHOW CASE AND BIN.—William V. Young, North Clarendon, Pa. The case or bin has a contracted bottom chamber provided with a chute having a valve or cut-off, in combination with a scoop having its bowl fitted to the bottom chamber, and having an adjustable false head at its inner end, being designed to facilitate dealing out the contents of the bin as merchandise.

SCIENTIFIC AMERICAN
BUILDING EDITION.

JANUARY NUMBER.—(No. 39.)

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NEW BOOKS AND PUBLICATIONS.

THE PRINCIPLES OF THERMODYNAMICS, WITH SPECIAL APPLICATIONS TO HOT AIR, GAS AND STEAM ENGINES. By Robert Rontgen, Teacher in the Polytechnic School at Remscheid. Translated, revised, and enlarged by A. Jay Du Bois, Ph.D., Professor of Dynamic Engineering in the Sheffield Scientific School of Yale College. In two parts. Part I. General principles, hot air and gas engines. Part II. Heat, steam, and steam engines. With 103 wood cuts in the text. Second edition. John Wiley & Sons, New York, 1888. Pp. xx, 707. Price $5.

The work opens with two lectures of Professor Verdet on the mechanical theory of heat, giving popular and scientific expositions of this important subject. The investigation of heat engines forms the subject proper of the second lecture, and it also gives a very complete review of those applications of the new theory which lie outside the domain of physics, and especially of mechanics. The part of the work on thermodynamics, immediately following the lectures and notes, contains the mathematical treatment of the subject of heat, and is presented in an elementary form well suited to beginners, demanding of them only a knowledge of algebra and the simplest principles of mechanics. Following this portion, we have another valuable feature of the work, in the application of the theory of heat to all the more important cases arising in practice. This has been so fully and completely done as to make the work extremely valuable as a book of reference. Numerous practical examples have also been given, with the reduction and heat tables necessary for their rapid solution. An abstract from Mons. Pernolet's work, "L'Air Comprimé," follows, containing, among other things, a diagram of practical value, inasmuch as the important quantities—initial pressure and degree of expansion—can be directly obtained from it for an engine consuming a given quantity of air and of a given horse power. Zeuner's theory of superheated steam is another of the valuable additions to English engineering literature contained in this new work. In the portion relating to superheated steam, as in other portions of the work, the practical bearings of the subject have received full consideration. There is also a summary of the principle which should govern the construction of the steam engine. A complete calculation of a proposed engine is given, taking into account the action of the steam in the cylinder, the proper degree of expansion and compression, the cross section of steam passages, the theory of the crank, the dimensions of journals and flywheels, the mean effective pressure for overcoming the resistance of friction and for working the cold water and air pumps, the consumption of steam and fuel per hour, and the cost of a horse power per hour. Complete steam tables are given, both for English and French measures.

ELEMENTS OF MACHINE DESIGN. By J. F. Klein, Professor of Mechanical Engineering in the Lehigh University. The Comenius Press, Bethlehem, Pa., 1889. Pp. vi, 208.

The subject of scientific design of machinery elements, including gearing, bolts and nuts, screw threads, keys, belt gearing, rotating pieces, bearings, and connecting rods, is very fully treated in this book, with full formulæ and many illustrations of parts. The illustrations are on bond paper, and are designed with special reference to be made subjects of studies for mechanical draughtsmen. At the end of the book a number of supplementary tables for calculating gearing are given. The work, in a short compass, contains an immense amount of material and illustrates a type of book which should be in the hands of every intelligent machinery constructor.

ALGEBRA, AN ELEMENTARY TEXT BOOK, FOR THE HIGHER CLASSES OF SECONDARY SCHOOLS AND FOR COLLEGES. By G. Chrystal, M.A., late Fellow and Lecturer Corpus Christi College, Cambridge; Professor of Mathematics in the University of Edinburgh. Part I. Adams & Charles Black, Edinburgh, 1886. Pp. xx, 542.

The first part of this elaborate work, following the general order of algebraic treatises, goes through fractions, ratio and proportion, equations, series, logarithms, interest and annuities. Although purporting to be merely an elementary text book, the fact that the first part comprises nearly 600 pages gives some idea of the thoroughness with which the matter is treated by the distinguished author.

LA TELEGRAHPIE ACTUELLE EN FRANCE ET A L'ETRANGER. Par L. Montillot. Paris, J. B. Bailliere et Fils, 1889. Pp. viii, 334. 131 illustrations.

This book, liberally illustrated, treats of the different kinds of telegraph apparatus in actual use, the subject of batteries and their arrangement with particular reference to telegraphic uses, and various designs for poles and general line installations and many practical details make up the work. A rapid apparatus of the Wheatstone type and multiple transmission apparatus and marine telegraphy are included. A portion of the work is devoted to the telephone.

ELEKTRISCHE APPARATE, MASCHINEN UND EINRICHTUNGEN. Von W. E. Fein. Stuttgart, 1888. Pp. xii, 292. 297 illustrations.

A large series of electric apparatus for which the author of this work is responsible is described in its pages. The different pieces of apparatus are described, each one in the order of its production as regards time, beginning with the year 1867. The dynamo-electric machine is described. Through successive years the work carries us down to July, 1887, under which date a new form of a bipolar dynamo-electric machine is given. Between these two dates a great variety of apparatus is

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described, including clocks, telephones, lighting apparatus, signaling appliances, telegraphy, measuring apparatus, etc. As the chronological order followed causes the apparatus to be described without any reference to a general plan, a table of contents is given, in which the whole body of material is systematized and the different subjects are referred to by page number. A portrait of the author is also given.

DIE ERZEUGUNG UND VERTEILUNG DER ELEKTRIZITAT IN ZENTRAL-STATIONEN. Von Dr. Martin Krieg. Band II. Magdeburg, 1888. Pp. xvi, 376.

Central station plants, with details for wiring districts, the use of accumulators, systems of regulating the current, and all practical details which come under this subject, are very fully treated in this work. It is illustrated by 141 cuts, and numbers of formulæ are given throughout the work for calculating the working of different types of apparatus. The illustrations are both diagrammatic and perspective, and the entire work gives a very full view of the subject of electric lighting plant.

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New carpet stretcher patent for sale or on royalty. E. C. Ellwood, Green's Farms, Conn.

For 2, 3, or 4 cylinder compound engines address Syracuse, N. Y., Yacht Engine Works.

Air compressor for sale cheap. Also steel tanks, iron rail, cars, etc. Address The Buffalo Wood Vulcanizing Co., Buffalo, N. Y.

Pratt & Letchworth, Buffalo, N. Y.,
solicit correspondence relative to manufacturing specialties requiring malleable gray iron, brass, or steel castings.

For the latest improved diamond prospecting drills, address the M. C. Bullock Mfg. Co., Chicago, Ill.

Link Belting and Wheels. Link Belt M. Co., Chicago.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Perforated metals of all kinds for all purposes. The Robert Aitchison Perforated Metal Co., Chicago, Ill.

The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

Iron, Steel, and Copper Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Friction Clutch Pulleys. The D. Frisbie Co., N.Y. city.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 28.

No. 11 planer and matcher. All kinds of woodworking machinery. C. B. Rogers & Co., Norwich, Conn.

Duplex Steam Pumps. Volker & Felthousen Co., Buffalo, N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(98) S. S. B. writes: Please give directions for ventilating a dry room. I want to know the correct method of removing vapor or dampened air from an artificially heated room used for drying fabrics, yarns, fibers, etc. Where should fresh air be let in, if at all, and where let out, or should the damp air be removed by exhaust from floor? If so located, at what height from floor? A. Drying rooms should have a fresh air inlet immediately beneath the source of heat. If a stove is used, it should be so arranged that the air shall enter and surround the stove and receive its heat before spreading into the room. If steam coils are used, they should be placed or spread a few inches above the floor, with the fresh air entering and spreading under the pipes. The amount of air passing through a drying room should not be so great as to depress the temperature to a degree that will lessen the time of drying, which should always be regulated to suit the amount of heat and the proportion of water to be evaporated. Very wet goods require strong heat as well as rapid circulation. The exit holes should be so distributed as to force the current through all parts of the room alike, especial attention being given to induce circulation of air in the corners. For goods that have passed through a wringer or centrifugal, the room should have a temperature of from 130° to 140°, with vent openings of one square foot to a thousand cubic feet of space, with natural draught due to the height of the room only. This can be increased by a flue or fan if enough heat is developed to keep up the temperature and thus expedite the work. The practice with some establishments is to close the room entirely with a full charge and heat the contents up to 175° and then ventilate, when the goods apparently steam themselves dry. This cannot be done if goods are required to be constantly fed to and withdrawn, as in the laundry business.

(99) F. H. P.—"Harden and temper" is the proper phrase to use in speaking of preparing steel tools. Tempering only refers to the reduction of the hardness to the required temper, which is generally regulated by the color of oxidation. The words "temper" and "tempering" as translated from the Odyssey and Pliny's works, and as used by writers in the middle ages, are used to mean the two operations of hardening and drawing to a temper, which is only a condition of hardness; so that, in this light, its use may by custom make it proper, but among those using technical distinctions for special operations the words harden and temper, or drawing the temper, have distinct meanings. The word temper is also applied to many mechanical operations that signify alloying or modifying.

(100) W. R. writes: In answer to query in the SCIENTIFIC AMERICAN, of September 1, 1888, query No. 18, concerning the relative power of engines, you state that one engine, 15¼ inches by 17 inches stroke, will produce 25 per cent more power than two engines, 12 inches by 12 inches, all conditions being equal. I differ from you in that respect, as the combined areas of the two 12-inch cylinders exceed the one 15¼-inch cylinder. Please explain why the indicated horse power is not greatest in the two 12-inch engines. A. The areas alone do not make a proper comparison between the two engines 12×12 and one engine 15¼×17. It is the volume or contents of the cylinders that should be compared at the same number of revolutions. The indicated horse power of the larger engine is 15 per cent greater than the two small ones. The difference in friction and loss by clearance, leakage, etc., will add about 10 per cent in favor of the large engine, making really an economy of 25 per cent.

(101) D. H. C. asks: How can I make a gold bronze solution? One of such a color as hardware trimmings are finished in. I have tried innumerable proportions of copper and zinc salts and also with the muriate of tin. The color runs direct from the red copper to the yellow brass, and I obtain no intermediate shades. A. The shading of the color in bronze mixtures of the salts of copper and zinc or tin is rather a delicate and difficult matter. It is done by touching the articles in solution with a stick of zinc to start a galvanic action, when by varying the quantities of the salts in the mixture a desired color may be had. See a most interesting and valuable article on the bronzing and coloring of metals in "The Techno-Chemical Receipt Book," which we can mail for $2.

(102) E. W. E. and L. T. & S.—To make printers' rollers, use:

Best glue	10½ lb.
Black molasses or honey	2½ gals.
India rubber, dissolved in alcohol	1 lb.
Venice turpentine	2 oz.
Glycerine	12 "
Vinegar	4 "

The above formula is given for the mysterious "black composition," so durable and elastic, and known but to very few persons until recently. Purified India rubber only is used. To recast add 20 per cent new material. The old home receipt is, 2 pounds best glue, soaked over night, to 1 gallon of New Orleans molasses. Will not recast.

(103) E. B. writes: Can you give me any information regarding an invention for producing power from sound? I have read of such a discovery having been made, but I cannot obtain any information as to whom the inventor is or what the invention consists of. Can you enlighten me? A. You probably refer to Edison's motophone. This is fully described and illustrated in the SCIENTIFIC AMERICAN of July 27, 1878, page 51. The motions of a diaphragm carrying a ratchet and pawl or claw, and spoken against, cause a wheel to rotate. It is only a scientific curiosity.

(104) G. H. writes: I would ask if there are sea-going steamships that have propellers forward and aft. If not, would it not be practical to have propellers in both ends of sea going steamships? A. No such steamer is now running. It would seem quite practical to build one. The long shaft would, however, occupy valuable room. A ferryboat is devoted to deck accommodation, and an ocean steamer to hull accommodation, hence the double screw is better adapted to the former.

(105) J. McJ. & B.—In article on page 356, referring to manufacture of wine, to reduce figures given to American weights and measures make following substitutions. For liters read 0·88 quart, for kilogramme read 2·02 pounds, For hectoliters read 88 quarts. For 15° C. read 59° Fah. (common thermometer), for 20° C. read 68° Fah., for 30° C. read 86° Fah.

(106) Inquirer asks for a recipe for koumiss. A. Consult SCIENTIFIC AMERICAN SUPPLEMENT, No. 130. Also SCIENTIFIC AMERICAN, vol. 51, pages 3 and 225.

(107) W. W. C.—Small streams that have not been used by the public, or made navigable by special act, can be fenced by owners of property through which they run. Having been so fenced for a time without objection from others interested in keeping the stream free, the title becomes legal as against the right of breakage, but does not bar a legislative act making the steam a navigable one in law.

(108) J. J. C. writes: I would like to know from you what illuminating gas will dissolve. A. Nothing under ordinary conditions. It will attack gradually hydrocarbons, and soft India rubber, but no true solution in the gas occurs.

(109) H. A. G. asks: What would be proper speed for line shaft in machine shop, doing light work? A. For light shafting, 175 revolutions per minute is a convenient and medium speed. Circumstances may require more or less, from 150 to 250 revolutions. The higher speeds are generally used for woodworking machinery.

(110) J. J. T. asks: How many heat units are there in one pound of (*a*) good coal. Also of (*b*) average coal. A. (*a*) 7,760; (*b*) 7,500.

(111) J. P. E. asks if the battery described in SCIENTIFIC AMERICAN reference book will do for electro-plating; if so, how large should it be made to run a vat containing one gallon of nickel solution? A. The battery is too small; the plates should be held in a jar six or eight inches deep and four inches apart. Three or four such would answer for a gallon bath. We advise you to study our SUPPLEMENT on electroplating before trying it practically.

(112) E. C. B.—There are many ores of copper—malachite or carbonate, oxides, sulphides, etc., and finally native copper. The latter may be nearly pure metal, and some of the low grade ores may run below ten per cent of metallic copper.

(113) O. G. writes: In melting granulated sugar, a blue scum rises on the top. Is it injurious? A. No; from the description it is impossible to say what it is.

(114) The writer is seventy years of age, and has been a constant reader of your paper since the issue of its first number, and I have a number of the paper by Porter that preceded its issue. I think I have perused the columns of every copy of the SCIENTIFIC AMERICAN, and a large part of the SUPPLEMENT. I have a fine specimen of a bolide or meteorite, and all the phenomena of their passage through our atmosphere are explained in scientific writings except their explosion, which sometimes occurs. I have witnessed the explosion and heard the report of one that passed over the city of St. Louis many years since. My inquiry is, what is the cause of their explosion, or how does it occur? I think a correct explanation in the SCIENTIFIC AMERICAN would be read with interest by others than myself. R. F. STEVENS, M.D.

A. As to the cause of the explosion of the meteorite, Haidinger suggested that it was not due to the breaking of the meteoric mass, but rather to the sudden rush of air into a vacuum which is so quickly left behind in the early part of its course. Perhaps of considerable interest in this line is Maskelyne's reference to the three explosions of the meteor which fell at Butsura, India, on May 12, 1861. They were heard at Goruckpur, 60 miles distant. Fragments of the stone were picked up three or four miles apart, and, strange to say, it was possible to reconstruct with considerable certainty portions of the meteorite of which they were a part. In this case two of the fragments found some miles apart fitted perfectly, and were not incrusted at the surface of the fracture, indicating a second explosion or rupture of the time when the velocity of the meteorite had been so far reduced that the material of the new pieces was not melted to the generation of heat. Of the meteoric stone which fell on May 13, 1864, at Orgueil, France, fragments reached the ground before the sound of the explosion was heard, proving that the fracture had taken place at a period of its course when the velocity was greater than that of the sound vibrations, which travel 1,100 feet per second. Hence it is believed that the sudden generation of heat resulting in the expansion of the outer shells accounts not only for the breaking of the meteorite into fragments, but also for the crash like that of thunder which is the usual accompaniment of the fall of the meteorite. After the explosion sounds are generally heard which have been likened to the flapping of the wings of wild geese, roaring of fire in the chimney, and rumbling of the vehicles over the pavement, tearing of calico or the bellowing of cattle, which are evidently due to the whirling of the fragments in the air in the vicinity of the observers. GEORGE F. KUNZ.

(115) J. J. asks how to reduce objects to microscopic size by photography. A. Place along side of the object to be reduced a large hand bill with big printed letters thereon. Then carry the camera far enough away until the print is just clearly discernible on the ground glass, or, in photographic terms, is accurately sharp. The image of the object to be copied will then probably appear too small to be seen by the naked eye. Make the exposure in the regular way. By examining the resulting negative with a microscope, the details of the object should appear distinct and clear. From the negative, positives on glass are readily made.

(116) G. J. H. asks for a platinum toning solution. A. The following is recommended as a good platinum toning solution:

Chloride platinum	1 grain.
Nitric acid	1 minim.
Water	4 oz.

(117) F. W. A. asks how to save the silver from dry plates that have been carelessly exposed to white light. A. Prepare a strong bath of hyposulphite soda and water (4 oz. of water to one ounce of soda), put the plates in this until the film is cleared. When all of the silver in the plates has thus been dissolved out, immerse in the solution three or four strips of bright fresh zinc about two inches wide by six inches long. After standing about a week, the silver will collect upon the surface of the zinc. In lieu of this, the silver may be thrown down by a solution of sulphuret of potash in the form of a black sulphide. It is dried and submitted to further processes until it is refined. This is better done by a refiner. 2. How may a camera bellows full of pin holes be repaired? A. The best way is to remove it and make a new bellows out of paper, as described in SCIENTIFIC AMERICAN SUPPLEMENT, 625. A coating of an alcoholic solution of shellac and lamp black on the outside might stop the pin holes, but a new bellows is preferable.

(118) J. H. B. asks: What power would an overshot water wheel develop that is eighteen feet diameter, four feet buckets, with cogs screwed to spokes four feet from hub? Flume twelve inches square, pinion ten inches. A. With a 12 inch square open flume or a 12 inch square weir, which is indicated by your letter, with 18 feet fall the whole value will be 9 n. p.; with a well constructed overshot wheel you may realize 7½ effective horse power. If the flume is under pressure, we must know the head and length for a correct answer.

(119) W. W. S. asks how the soap composition used by painters as a vehicle is made. A. Slice 2½ lb. yellow soap and dissolve in 1½ gallons boiling water, and while hot mix and grind with 3½ gallons of oil paint of the desired color. This makes a flexible paint, suitable for canvas.

(120) J. M. W. asks: Which is the best engine for pleasure yachts, say 27 ft. over all, 6½ ft. beam, also the best motive power—steam, electricity, or compressed air; the best fuel, coal or oil or naphtha? What are the names of the different marine engines and companies who deal in them? A. There is quite a variety of engines for small yachts or launches, with steam boilers using coal, crude and refined petroleum, and naphtha. We cannot undertake to particularize in these columns as to which would be best for special uses, but advise you to write to some of our advertisers for their catalogues. Electricity has not yet been made practically available for such purposes except in an experimental way, and compressed air, we believe, not at all.

(121) S. B. D. L. asks us to publish instructions how to set the valve of a plain slide valve engine. Also how the cam on engine shaft should be set. A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 13, which we mail for 10 cents.

(122) J. C. T. asks: What kind of oil should be used for drawing the temper of steel, the oil to be heated to 500° or 600°? An oil that will not take fire, heats readily, and does not evaporate too fast is what is wanted. A. There is no oil that does not take fire at some temperature. Linseed oil boils at 597°, whale oil at 630°. Whale oil is the best to temper with.

(123) G. V. asks: 1. How do you account for the so-called Northern Lights and the Dipper stars, being seen toward the south when observed from positions north of the 78th degree? A. The Dipper stars have a less latitude than 78°. The Aurora or Northern Lights are supposed to have a focal point around the magnetic pole, which is in latitude 70° in North America. Hence observers at the north of the magnetic pole will often see the Aurora at the south, though not always. 2. How is it that the sun in the neighborhood of Behring's Strait can be seen due north on the night of June 21? A. Because it is in sight for 24 hours during the long summer daylight, and hence is during part of its course due north. 3. If Keely's motor is a humbug, as you have often published, then why did the chief justice put him in jail? A. Keely was imprisoned for contempt of court-mandamus.

(124) W. O. suggests that lamp chimeys at the bottom should be made large enough to get the hand in for cleaning purposes, and that a diameter of four inches would answer. This would also give a broader base for the chimney, and make it safer.

MINERALS, ETC.—A specimen has been received from the following correspondent and examined with the results stated.

C. E. H.—The mineral is iron pyrites, of no value. Many species oxidize and go to pieces in the air.

Enquiries to be Answered.

The following enquiries have been sent in by some of our subscribers, and doubtless others of our readers will take pleasure in answering them. The *number* of the enquiry should head the reply.

(125) I have been staining ivory with a solution of nitrate of silver. After remaining in the light a few minutes it turns black, but after being excluded from the light awhile it turns to a pale yellow. On being exposed to light again, it turns black again. Can you inform me of anything that will keep it a permanent black, or of anything in place of it?—E. J. D.

(126) In a discussion with a gentleman widely noted for his good judgment on certain scientific questions, I could not agree with him on the question of heating a room, and appeal to the SCIENTIFIC AMERICAN as referee. We are heating with overhead steam pipes, and he claims that a ventilating grate at the bottom of a flue would assist in heating the room—would suck out the cold air at the bottom and pull down the hot air from above. I claim the only effect of the grate would be better ventilation at the expense of heating, as cold air must come in from outside the room if any is led away up the flue from the inside. 2. Can an air-tight room be heated with a coal or wood stove within it? And if not, why? 3. Do you accept the theory of direct heat rays from any heated surface? My disputant claims heat is only conveyed by air next an object becoming heated and in turn heating contiguous objects.—B. L. A.

(127) Is there any process by which the green and blue stains found in rock can be produced permanently by artificial means, that is, by chemicals or heat?—H. W.

(128) Please to inform me how to make violin bow resin.—O. S.

(129) I would like to know if the aldermen of a city have the legal right to grant privileges to individuals or corporations in the public highway, that are detrimental to the traveling interest, and if they can, is there any limit to their power?—E. R.

(130) I have a military uniform that is trimmed with gilt braid. The braid has become dirty looking. Can you please inform me how I can brighten the braid without injuring the cloth?—P. C. W.

(131) Two pulleys exactly alike and each doing the same work in the same time, say, for instance, lifting a load of 1,000 pounds; in one case the pulley does the work directly, in the other case a countershaft is used and geared two to one, one pulley of course running twice as fast as the other one; S claims that the pulley running fastest will require less set

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screw power to do the work than the pulley which runs slower and does the work direct. P claims that there will be no difference of set screw power required, or, if any, the slower pulley would require less on account of having no countershaft to drive. Which is right?—S. B.

(132) How would I proceed to harden a razor which is hollow ground and quite soft, so much so that it requires honing every three or four weeks. It will not hold an edge. Are there any chemicals that I could use without resorting to tempering in the forge? —W. H. M.

(133) I want to transform a current of carbon monoxide (CO) into carbon dioxide (CO_2) by other means excepting combustion. Will you kindly show me a solid substance, cheap and abundant, that contains oxygen in such statethat, on passing by it, the carbon monoxide takes oxygen, and therefore turns into carbon dioxide?—J. A. M.

(134) If one has a 20 horse power engine, is it more economical (leaving first cost out of the question) to have a 20, 30, or a 40 horse power boiler?—C.

(135) Inform me through your columns how I can make and use a preparation for silver plating and one for gold plating.—A. A.

(136) 1. My neighbor owns a thrashing outfit, in which the power is conveyed from the horse power to the separator by means of a tumbling rod, in four sections, connected by four knuckle joints. The total deflection of the tumbling rod is about 40°. What percentage of the power is absorbed by the knuckles? 2. What course would you advise a young man to pursue who desires to become an electrical engineer? He has a good common school education. 3. As a profession, how will electrical engineering compare with civil engineering, during the next twenty-five years?—C. B. S.

(137) Please tell me what it would cost to make an induction coil as that described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161. Please tell me if aniline green contains any copper in solution. If not, what gives it the copper appearance when in a liquid state?—Wm. R.

(138) Will you kindly inform me the initial electro-motive force and the strength of current of the following batteries: 1. The Disque Leclanche. 2. The Fuller mercury bichromate battery. 3. The perforated cup battery, size 4 in. square. 4. The Bunsen battery spoken of in correspondence No. 34 of SCIENTIFIC AMERICAN of December 1, 1888. Which is desirable for electric bells, a battery of high E. M. F. or one of considerable strength of current? For miniature incandescent lamps? What kind of iron is the best to use in a casting of the field magnet of the simple electric motor? If this motor be used as a dynamo, what current will it produce?—J. G. P.

(139) I want to make a cold box in an ice house, but without altering the ice house very much. It keeps ice all right, but my cold box inside of the ice house I can't get below 50°.—A. G. D.

(140) In a family of sixty, we use between 500 and 1,000 bushels of apples. Apple sauce is on the table three times a day, and the same with tomato sauce. We want vessels to cook these in, that will not poison us. Have tried the best we could find in market—copper washed with tin, agate, marbleized iron, etc., but all fail to give satisfaction; we are poisoned. If you can help us in this dilemma, it will be an act of humanity. The sisters want something light to handle.—F. W. E.

(141) Would you kindly inform me of any publication treating about the different trials in the United States of explosives, such as robinite, melinite, bellite, carbo-dynamite, graydonite, smolianoff, snyder, and where such works or publications may be had?—H. B.

(142) I have a quantity of pure chloride of silver, and would like to know how to convert it into pure nitrate of silver.—G. O.

(143) I have made the electro motor described by you some time since, with some slight variations, the principal one being cast iron field magnets, and have had quite good success. I now wish a machine to run as a dynamo to light an Edison 20 C. spiral lamp, which requires 30 to 38 volts, 1 to 1·5 amperes, and has a resistance of about 0·34 ohms. Can I make an armature which will take the place of the motor armature and give the required current? If not, can magnets and armature both be wound so as to produce the required current? If the resistance of machine cannot be kept low enough, will not a slightly increased voltage answer to produce required current? Lastly, if machine can be made, at about what speed should it be run?—H. M. P.

(144) Please inform me whether there are any chemicals, when put into a quantity of water (a tub of water for example), which will cause it to freeze, and what they are? What is the process for making ice? I am trying an experiment for keeping apples. I am going to make double wall building out of concrete, with about 18 inches space between the walls, and then fill the space full of water. And then I want to freeze the water in a body. Will I be able to accomplish it? How would fruit keep with just water alone in the space? Would it keep the temperature inside as low as 36 degrees? Would the water be liable to leak through the concrete walls? Apples will not keep well in California, in cellars under ground. They seem to keep better in double wall buildings above ground. Now I want to try and make a fruit house after the principles of these cold storage companies, so as to be able to preserve fruit perfectly for four or five months. Now can you give me any light on the subject?—H. W. C.

(145) How much power does it take to run a coffee mill, grinding 1 lb. of coffee? Height of mill is 2½ ft. It has two flywheels of 2 ft. in diameter, made by Enterprise Co., of Philadelphia, No. 12. A boy of 16 can easily grind 1 lb. of coffee without stopping. Will a C. C. ⅛ h. p. battery motor run it? Battery has E. M. F. of 12½ volts.; internal resistance, 1 ohm. Motor has resistance of 1-7 ohm. Will a ⅜ round belt transmit power?—A. M.

(146) What will make a durable ebony finish for a Georgia pine soda water counter? Please answer through the columns of the SCIENTIFIC AMERICAN. —F. McD.

(147) Can you tell us how to make stamping powder, such as is used with perforated paper patterns for stamping fancy designs on cloth, etc.? Something that will not rub off from handling while working the pattern.—F. P.

(148) I am going to make a photographic camera as described in SCIENTIFIC AMERICAN October 13, 1888, page 231. Instead of a spherical wide angle lens, I bought a 75-cent microscope or magnifying glass, brass mounted, with two adjustable lenses, focal length a little more than an inch. In order to get a fixed focus for all distances, a diaphragm probably has to be used, but I don't know the size of the opening for making instantaneous photographs. Would you please inform me whether the diaphragm should be placed between the two lenses or in front of them? Can such a microscope or a 75-cent reading glass be used in the construction of a lantern for enlarging small negatives?—W. L. W.

(149) Can a horse do as much work on a tread power as on a common circular horse power with the same exertion?—J. I.

(150) I owned a locomotive steam boiler three years ago, and it is still in use, that was built before 1854, and has had very little repairs? Are there many older boilers in use in this country? She has copper fire box and brass tubes.—J. E. E.

(151) I would like to know the composition of the varnish used upon canvas boats, to keep them from leaking. Also if said varnish will exclude air or common coal gas?—J. A. W.

(152) Is there a process by which crude oil, say the Lima crude oil, can be used as a fuel in kitchen stoves or parlor stoves? Or is there a burner made using crude oil for fuel for household purposes?—P. F. B.

(153) The mixture of salt with mortar has been spoken of recently as an effectual prevention of the crumbling of the mortar from frost. Will you please inform me the quantity and mode of admixture, and oblige a constant and attentive reader?—J. A.

(154) Please tell me what kind of acids I can use to remove the sand and hard crust from the castings, so as to leave them a bright brassy color and take the grit, so as not to wear the edge off the tools, also is there any chemicals that I can use in a steel ball, 1 3-16 in., that the loadstone will not have any affect when it drops into its seat as to hold the two together, as I wish to use a steel ball and seat? I wish to use them in oil wells, where the magnets or loadstone is bothersome. Also would you please tell me how I can make my brass moulder's sand tough, so as it will hold together?—W. H. W.

(155) Will you please answer through the question column of the SCIENTIFIC AMERICAN whether it is possible to run three circular saws through a log at the same time on one saw kerf? Please let me know if it has ever been done, and how. It is reported by some men from Washington Territory that there are some mills there that have such machinery for cutting up the large timber of that Territory. Some have disputed the possibility of it, and we have agreed to submit the question to you for settlement.—W. W. Y.

(156) Will you kindly inform me how the acoustic properties of a hall can be improved, the dimensions of which are 46 × 60 feet, and whose ceiling is oval-shaped? It is 12 feet to beginning of the curve of ceiling, and about 22 feet to top of same.—G. A. C.

(157) Which of the two boilers would be the more economical, using wood for fuel: No. 1, shell 5 ft. × 12 ft. with 86 three-inch tubes; No. 2, shell 5 ft. × 12 ft. with 150 two-inch tubes? Also which would last the longer? What per cent saving in fuel is there between a common slide valve and an automatic cut-off engine of 40 horse power?—W. McV.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the numbers therein given:

(52) Polishing Wire by Pickling or Galvanizing.—Neither of the processes you name will polish wire. The proper treatment depends on its material and how badly corroded it is. Rust may be removed from iron wire by soaking in solution of chloride of tin. Emery of increasing degrees of fineness, followed by rouge, putty powder, whiting, or rotten stone will polish metal.

(53) For Enamels for Clay Goods consult Spon's Encyclopedia of Industrial Arts, part 25. Also SCIENTIFIC AMERICAN SUPPLEMENT, 387 and 402.

(54) 1. Making Small Flat Springs.—Cut them off a watch or clock spring. To perforate, punch an indentation with a sharp-pointed punch and file off the projection or drill it. It may be necessary to draw the temper for this. If so, reharden again and draw to a blue color. 2. Printing Name on Velvet in Gold.—Dust with finely powdered resin or mastic and stamp with hot metal type. Afterward wipe off excess of gold. Or paint the letters with gold size and apply with cold type.

(55) Large and Small Hose Nozzles.—Other things being equal, a large nozzle will throw a jet of water higher than a small one. If the supply is insufficient, the small nozzle may throw the highest. The stream of water should not be "wire drawn" or throttled for either nozzle to work well.

(56) Horse Power Transmitted by Compressed Air.—A pipe 5 feet diameter and 1 mile long at 100 pounds pressure at inlet would transmit about 55,000 horse power; at 200 pounds pressure about 82,000 horse power. If 30 miles long, about one-fifth as much.

(57) Horse Power required to heat Iron Plates.—I have calculated this according to one formula with the following results: In heating a round iron plate 2 inches thick and 6 inches diameter to 1,000° Fah., about 160 electrical horse power would be absorbed. To heat it twice as hot, about 320 electrical horse power would be required. Allowing for conversion loss, etc., these figures might safely be increased to 200 horse power and 400 horse power respectively as giving the power of the engine. To heat a plate 4 inches thick and 8 inches in diameter to 2,000° Fah. would require about four times as much as for the smaller plates. No allowance is made for loss by conduction.—S. V.

(58) Tests for China Clay.—The quality may be judged by observing its whiteness and freedom from grit. It may bring from $10 a ton upward.

☞ Books or other publications referred to above can, in most cases, be promptly obtained through the SCIENTIFIC AMERICAN office, Munn & Co., 361 Broadway, New York.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

December 25, 1888,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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Air, apparatus for pumping and compressing, E. Kaselowsky 395,060
Alarm. See Electrical alarm. Fire alarm.
Animal trap, O. Huffman 395,054
Annunciator, A. Rosenberg 395,251
Anti-friction compound, J. B. Deeds 395,216
Architectural purposes, composition of matter for, C. Straub 395,091
Armature for dynamo-electric machinery, W. S. Belding 395,260
Armatures of dynamos, core for the, D. J. Hauss. 394,978
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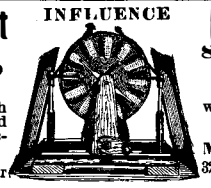
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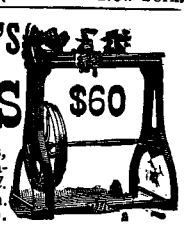

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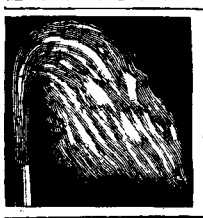
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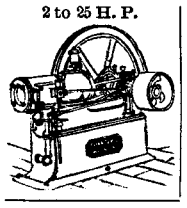
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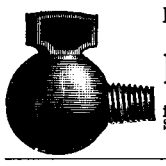
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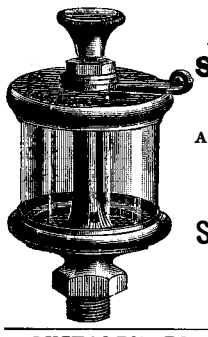
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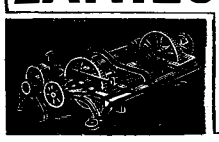
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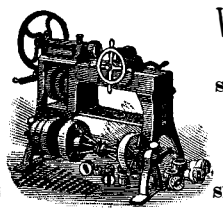
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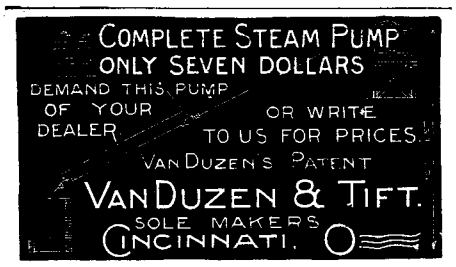

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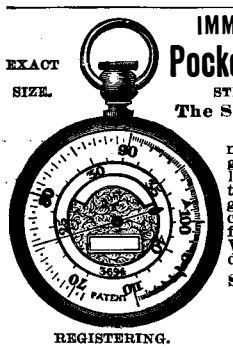

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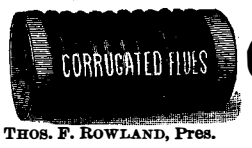

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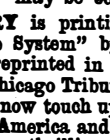

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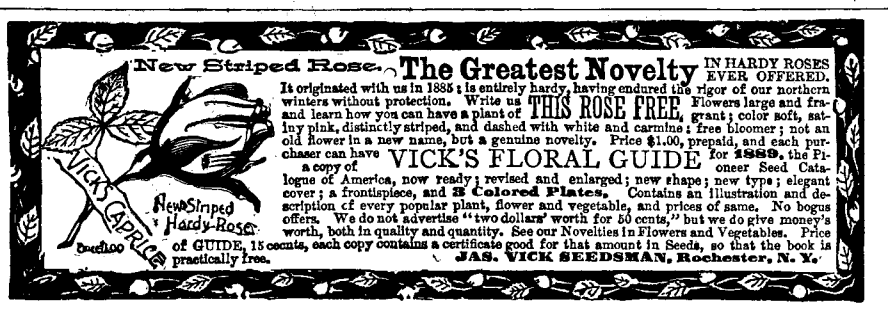
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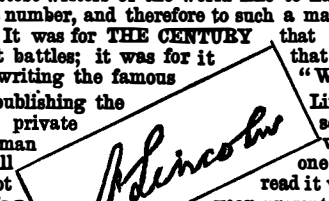

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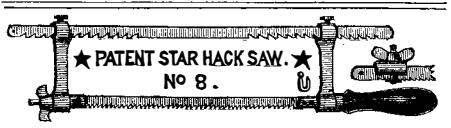

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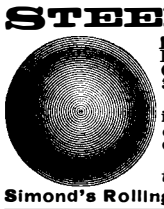

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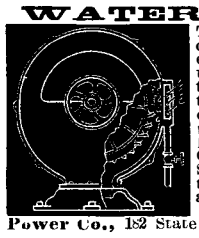

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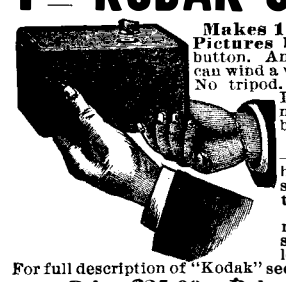

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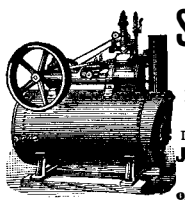

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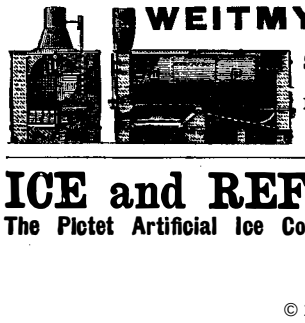

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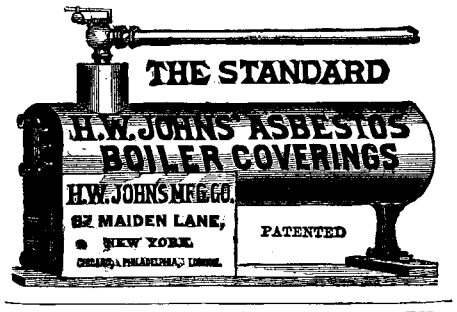

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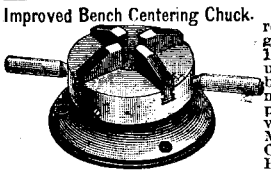

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